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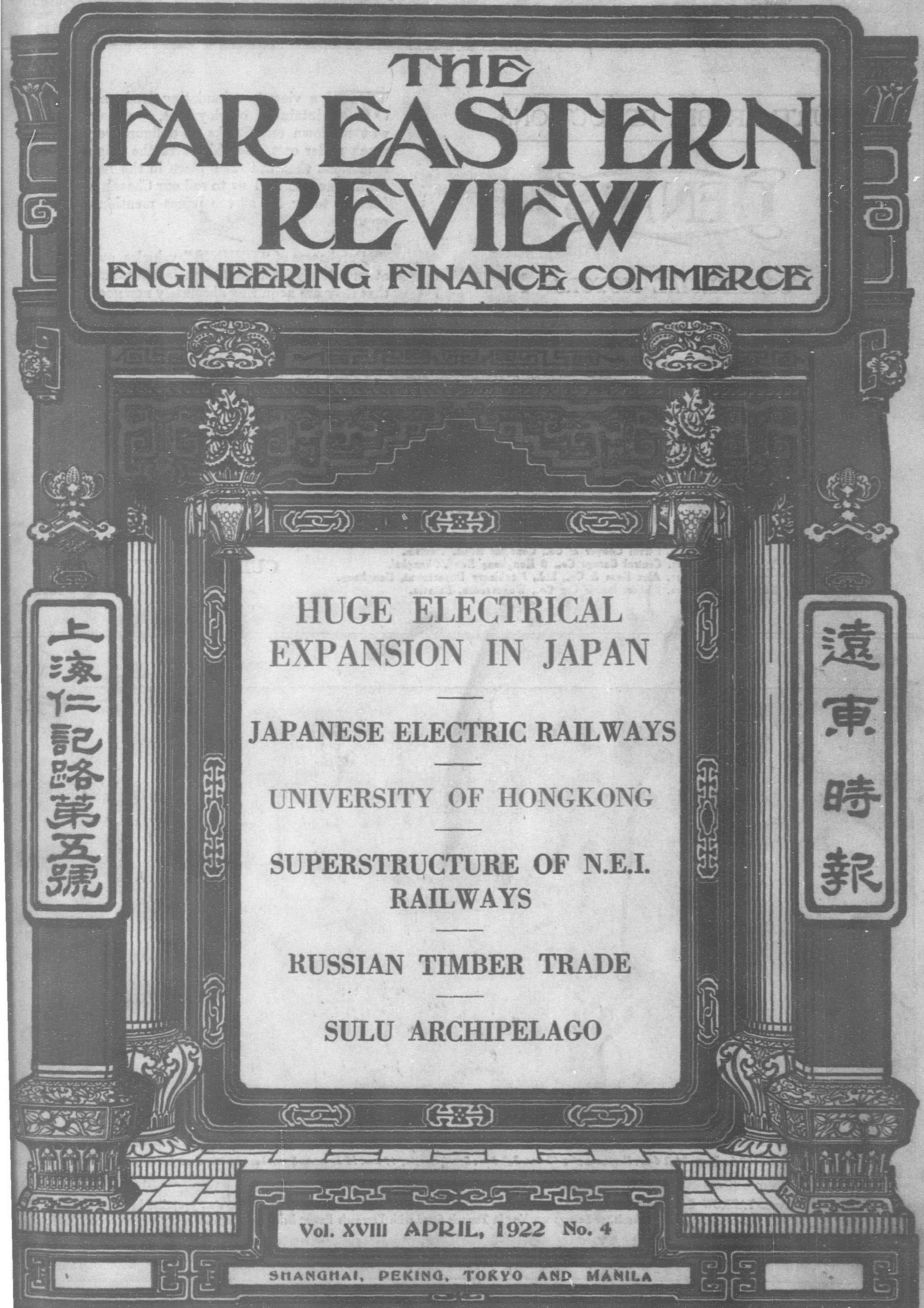

THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

遠東時報

上海仁記路第五號

HUGE ELECTRICAL EXPANSION IN JAPAN

JAPANESE ELECTRIC RAILWAYS

UNIVERSITY OF HONGKONG

SUPERSTRUCTURE OF N.E.I. RAILWAYS

RUSSIAN TIMBER TRADE

SULU ARCHIPELAGO

Vol. XVIII APRIL, 1922 No. 4

SHANGHAI, PEKING, TOKYO AND MANILA

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22
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3½-4-ton Char-a-bane Chassis ...	**£880**	£1,190	***£310***
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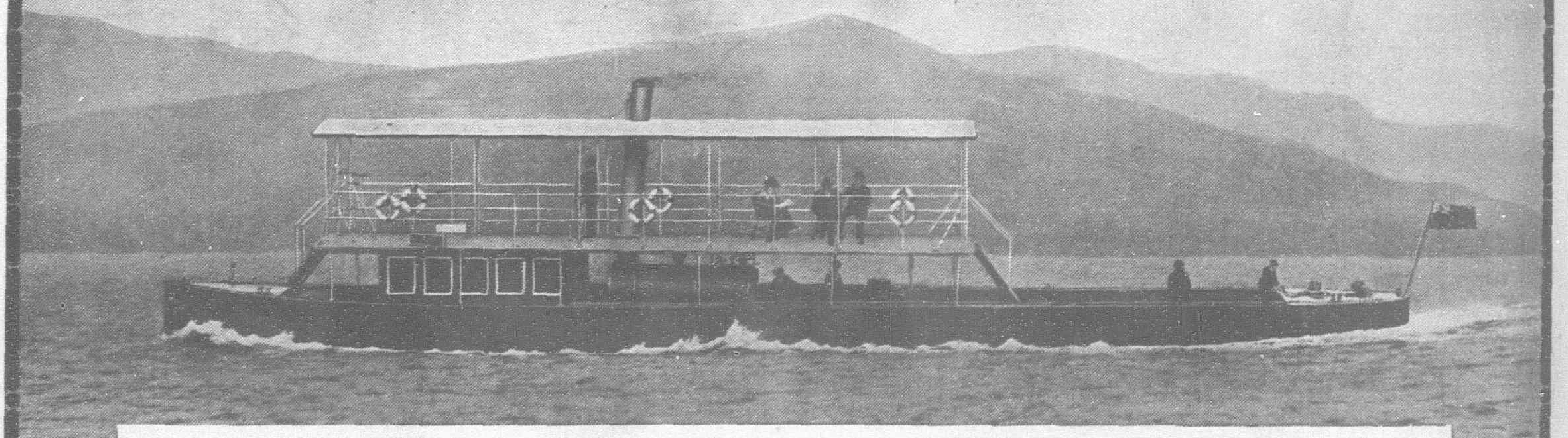

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

Vol. XVIII SHANGHAI, APRIL, 1922 No. 4

Huge Electrical Expansion in Japan

A Survey of Actual Markets for Materials

1. Hydro-Electric Enterprises

By B. C. HUGINS

AT the end of 1920 there were in Japan 831 companies generating electric power from hydro-electric installations. The total capital investment in those companies was Y.1,369,400,000, and according to the investigations of the department of agriculture and commerce the total power licensed for development by these 831 companies was 7,404,000 kilowatts. The total power developed by operating companies was 1,254,000 kw. Enterprises licensed but not yet operating will develop another 2,756,000 kw., and licensed applied for but not granted call for the development of 3,394,000 kw.

Many of these concerns were established in the heydey of Japanese prosperity when it was a simple matter to raise capital, but since the slump of 1920 a large part of those not yet licensed have been abandoned. There were many good prospects among them, but also many weak valueless concerns.

The minister of agriculture and commerce in a speech at the end of 1921 announced that there were Y.1,600,000,000 then invested in hydro-electric enterprises, generating 1,340,000 kilowatts. In this speech the minister deplored the tendency to rush into new hydro-electric enterprises without considering the needs of the different parts of the country, and strongly urged his hearers to amalgamate their conflicting interests and thereby save many duplications of equipment which were only a costly drain on the finances of the nation.

Before this official appeal for amalgamations and annexations was made there had already been a growing tendency for the larger corporations to absorb the smaller concerns operating in or contributing to the power needed in their supply districts. Newly organized companies possessing valuable water rights were especially desirable purchases for old concerns, and the amalgamations carried out in 1921 strengthened the industry and the nation as a whole.

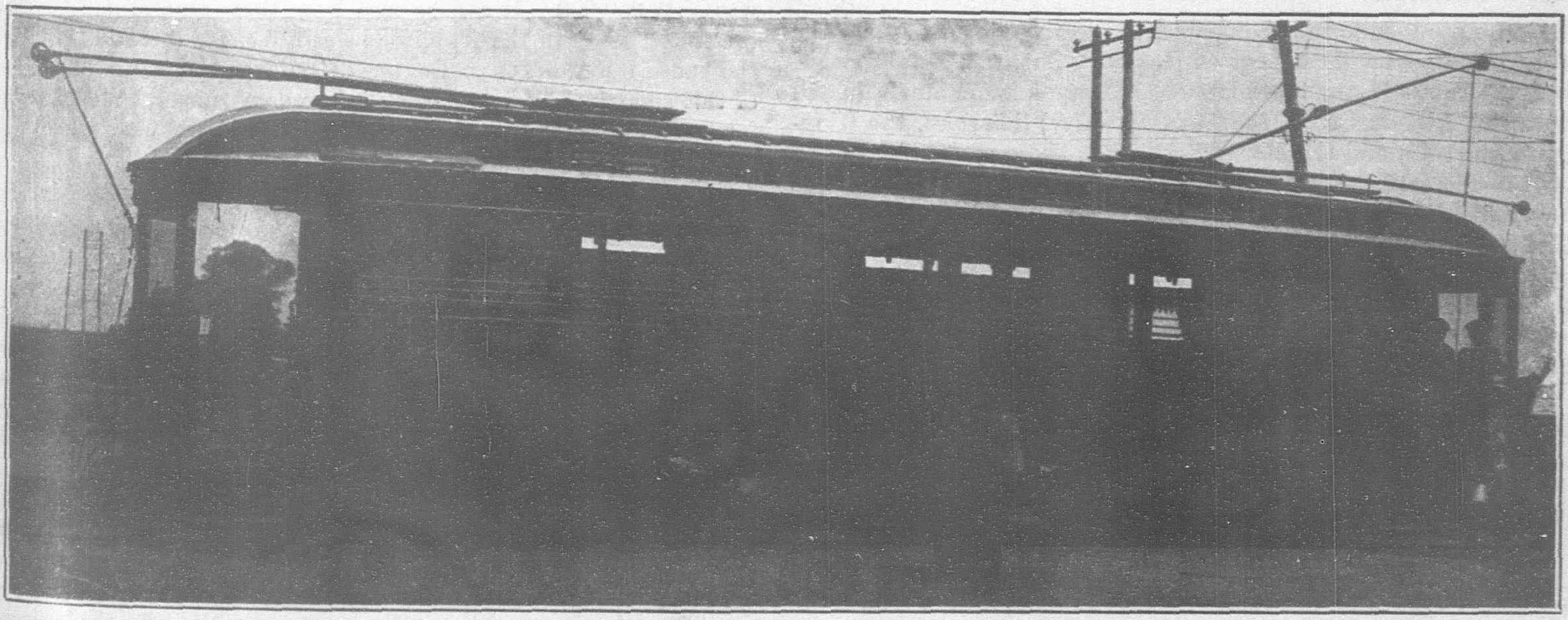
The Kwanto-Eastern District

In the Kwanto, the district of Japan covering Sagami, Izu, Musashi, Kosuke, Shimosuke, Hidachi, Kazosu, Shimosa provinces, east of the Hakone mountains, including the cities of Yokohama and Tokyo, is the most important population centre in all Japan, and the centre of the greatest power interests now operating.

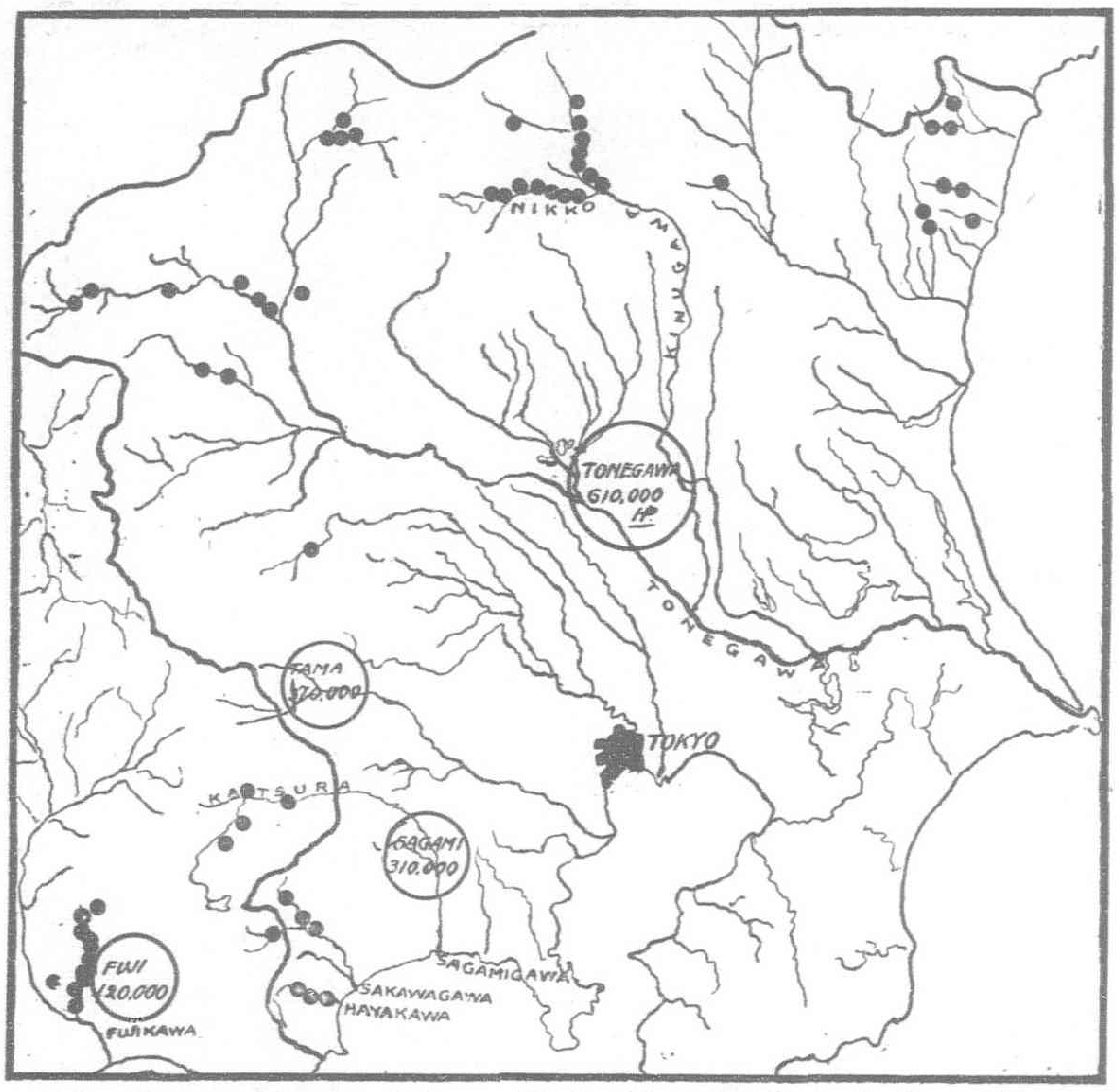
The most important water powers in this district are supplied by

1. The Tonegawa (river) and its branches.
2. The Sagamigawa.
3. Other minor rivers and their tributaries.

The Tonegawa water shed extends over the prefectures of Gunma, Tochigi and Saitama. There are more generating plants along this river and its branches than in any other part of Japan, and the generating stations are for the most part the largest in



Electric Tramcar on the Keihan Electric Railway Operating between Osaka and Kobe. Car body manufactured by the Kisha Seizo Kaisha of Osaka and equipped with four Dick Kerr Traction Motors, Type D-K, 9-C, 5 H.P.



The Kwanto District of Japan. Hydro-Electric Plants in Operation, 2,000 Kilowatts and upwards

the country. There are 133 generating stations in all, producing 612,000 kilowatts distributed by forty operating companies.

The principal companies operating in the basin of the Tonegawa are—

Company	River Basin	Power developed	
Kinugawa Suiryoku Denki	Kinugawa	55,440	kilowatts
Nikko Denki Kido (Electric Railway)..	Daiyagawa	180	,,
Shimotsuke Denryoku (Now Tokyo Dento)	,,	2,060	,,
Shimotsuke Denryoku (Now Tokyo Dento)	Kinugawa	3,650	,,
Takasaki Suiryoku Denki ..	Karasugawa	1,800	,,
Tonegawa Hatsuden Sho (Now Tokyo Dento)	Katashinagawa	22,556	,,
Gunma Denryoku	Agatsumagawa	28,963	,,
Kwanto Suiryoku Denki ..	Tonegawa	20,000	,,
Musashi Suiden	Jinryugawa	1,100	,,
Musashi Suiden	Arakawa	1,800	,,

The most important companies in the Kwanto to-day are the Tokyo Dento, the old Tonegawa Hatsuden Sho, now amalgamated with the Tokyo Dento, the Shimotsuke Denryoku, now amalgamated with the Teikoku Dento, the Takasaki (City) Suiryoku, the Kinugawa Suiryoku and the Musashi Suiden. These companies to-day have a generating capacity of 600,000 kilowatts, while their plans for the future call for the development of another 300,000 kilowatts. The Shikanuma Suiryoku Denki utilizing the waters of the Oashigawa has not yet completed an ambitious new project to supply some 20,000 kilowatts.

The other rivers in the Kwanto and some of the more important companies located along them are—

Arakawa :	Musashi Suiden. Kwanto Suiden.
Tamagawa :	Kwanto Suiden.
Sakagawa :	Sagami Suiryoku. Fuji Gasu Boseki Denryoku Ba.
Hayakawa :	Yokohama Denki, now Tokyo Dento. Odawara Dentetsu (Electric Railway.)
Agano River Basin :	Inawashiro Suiden.
Abukumagawa Basin :	Koriyama Denki. Tadami Gawa Suiryoku.
Fujikawa Basin:	Fuji Suiden. Hayakawa Suiryoku, which supplies power to the Keihin Denryoku Co. (Tokyo-Yokohama Electric Power Co.)

There are many other companies operating in the Kwanto but the centre of all of them is the powerful Tokyo Dento K.K. (Tokyo Electric Light Co., Ltd.) The Tokyo Dento has recently effected important amalgamations with the Nihon Dento, the Yokohama Dento and the Tonegawa Hatsuden Sho greatly increasing its capital to bring about the expansion of its boundaries and business. At the end of June, 1921, the authorized capital of the Tokyo Dento was Y.166,000,000. Its hydro-electric power plants generate 74,800 kilowatts, and its coal burning power plants add 29,700 kilowatts to that amount, making its total power generated, 95,500 kilowatts. It supplies 3,221,000 lights in and around Tokyo city, and sells 170,000 kilowatts for motive power, partly purchased from others. This company to-day is the greatest supplier of electric power in all Japan, and as it is increasing its equipment and power all the time, its future is very promising.

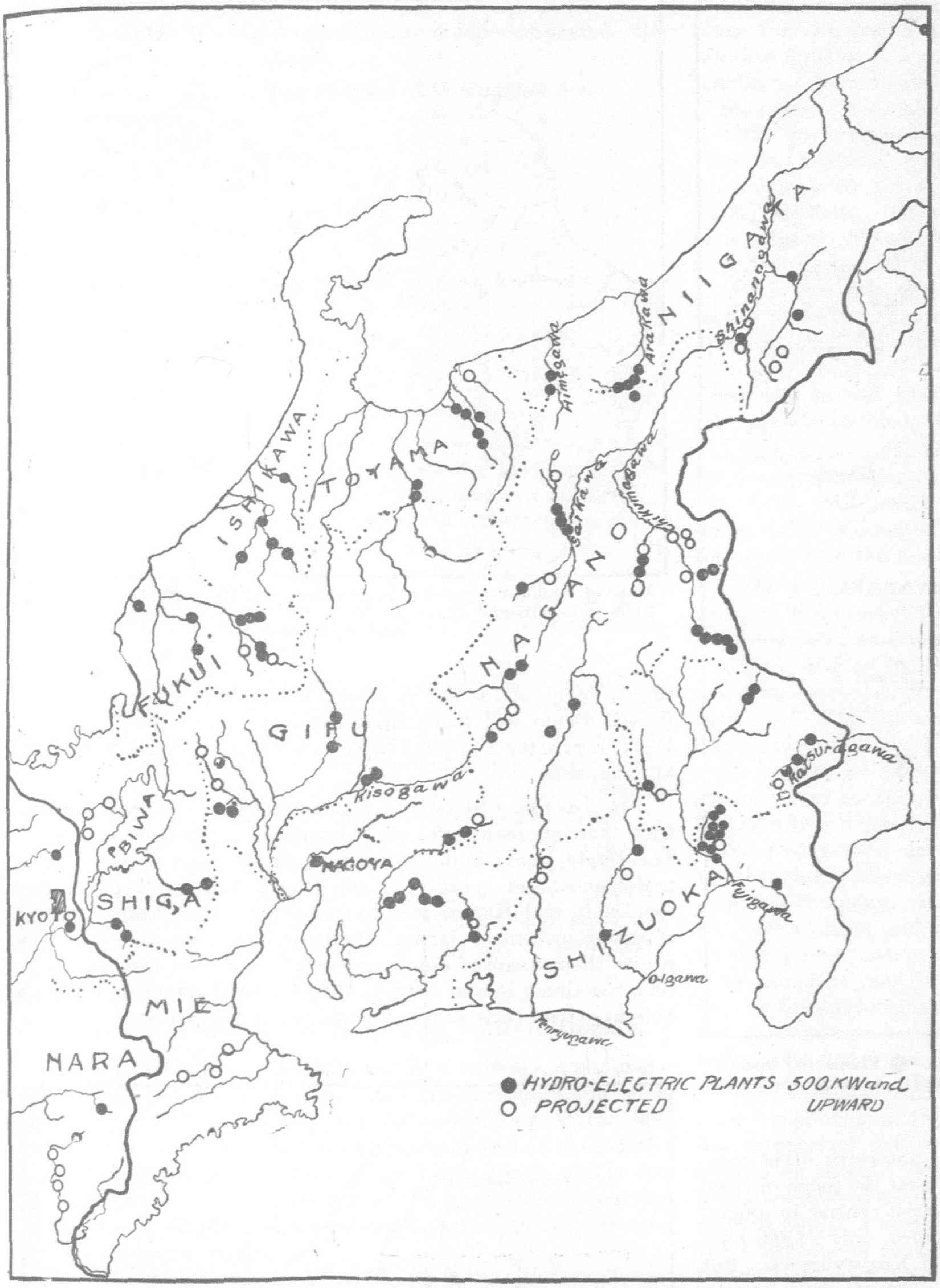
Since July, 1921, the Tokyo Dento has added to its organization the business of the Takasaki Suiryoku Denki, the Kumagawa Suiryoku, and the Nichiei Suiden and the Oshima Suiden, which, at first amalgamated with the Hayakawa Suiden, become the property of the Tokyo Dento when the Hayakawa company was absorbed in September, 1921. The Hayakawa before it fell into the hands of the Tokyo Dento was expanding its business in all directions, although its own construction plans were not yet completed. When its new power stations are completed they will generate 21,300 kilos from water power and 1,000 kilos from coal-burning plants. It was also rumored that the Tokyo Dento was contemplating the purchase of the Keihin Dentetsu (Tokyo-Yokohama Electric Railway), but this is denied by the action of the Keihin Dentetsu in purchasing the Gunma Denryoku which will generate 28,963 kilowatts when its plants are completed. By its purchases of the Takasaki Suiryoku it added 3,355 kilowatts, by the Kumagawa Suiryoku 2,386 kilowatts, and by the Hayakawa 6,100 kilowatts to its already large water power productive capacity. These companies also generalte small amounts of power from coal-burning plants, and all together they produce 15,000 kilowatts, a very welcome addition to the Tokyo Dento's supplies. Their combined capital before the annexation was Y 21,000,000.

Lately the Katsuragawa Suiryoku was also incorporated into the Tokyo Dento organization, adding another 33,000 kilowatts to its already great power supplies. The capital of the Katsuragawa was Y.42,000,000. It can be seen from these amalgamations that the water power of the Kwanto is slowly being concentrated under the control of the Tokyo Dento. The plans for future expansion of this company are very ambitious, and its constant reaching out for more and yet more power is a source of great anxiety to less favorably situated companies.

The Inawashiro Suiden has a capacity of 61,500 kilowatts, and it supplies power to Tokyo and Tokyo vicinity. Recently it entered into a contract of amalgamation with the Koriyama Denki and the Tadamigawa Suiryoku operating in the Abukawa (river) basin. The Koriyama generates 12,000 kilos, and the Tadami, which is still very young, supplies 500 kilos, but it has very valuable water rights which can be developed at very little cost. There are many small companies in the same river basin, the Fukushima Dento, Abugawa Suiryoku, Aiza Denryoku, etc., which will all probably be annexed to the Inawashiro in the near future.

The Kinugawa Suiryoku Denki K.K. is the third great company operating in the Kwanto. It generates 33,000 kilowatts, from water power and 13,000 kilowatts from coal. The Tokyo city electric bureau purchases 37,300 kilowatts from the Kinugawa.

These three companies are the great competitors for the business of electricity supply in Eastern Japan. But although there are



Map of Central Japan, showing Hydro-Electric Plants. ● In Operation, 500 Kilowatts and upwards, O Projected

many conditions existing to-day which tend to keep them apart, they will in all probability be combined in one large organization at no far distant date. Such a combination would be all powerful, in the Kwanto at least, and it would leave no room at all for any competitor to live in.

Central Japan, from Numadzu to Kobe

From the point of demand for power the Kansai district, centering around Osaka, is in no way behind the Tokyo district, the centre of the Kwanto. In Osaka and Kobe the demand for electric power is very great indeed, but water power is very scarce because there are no rivers in this district which have sufficient fall to make them valuable sources of power. Only in the basins of the Yodogawa and the Yamatogawa is there any available power. Practically all the water power which can be economically developed along those rivers has already been used up, consequently the Kansai is obliged to go outside its borders into the central districts, Chubu, the north-eastern part of Japan, the Hokuroku, and the Tokai, the district between Tokyo and Kyoto, in order to get power enough for its needs. These three districts are now competing for the business of the Kansai.

The Ujigawa Denki K.K. and the Daido Denryoku K.K. are the two great competitors for the business and power rights in this field. The Ujigawa Denki is a part of the earlier company the Kansai Suiryoku Co., and it still uses coal to generate power for most of its service. Its future prosperity has been threatened by the continual growth of the Daido Denryoku which has recently absorbed the Nihon Suiryoku, the Kiso Denki Kogyo and the Osaka Soden K.K.

The Ujigawa Denki, in competition, however, has made every effort to keep up with the Daido Denryoku, and it has entered into co-operative arrangements with the Nihon Denryoku, Wakayama Suiryoku, and the Kansai Denki, which was formerly the Nagoya Denki now annexed to the old Kansai Denki. These arrangements make the future of the Ujigawa, and the co-operating companies, secure against the growing power of the Daido Denryoku.

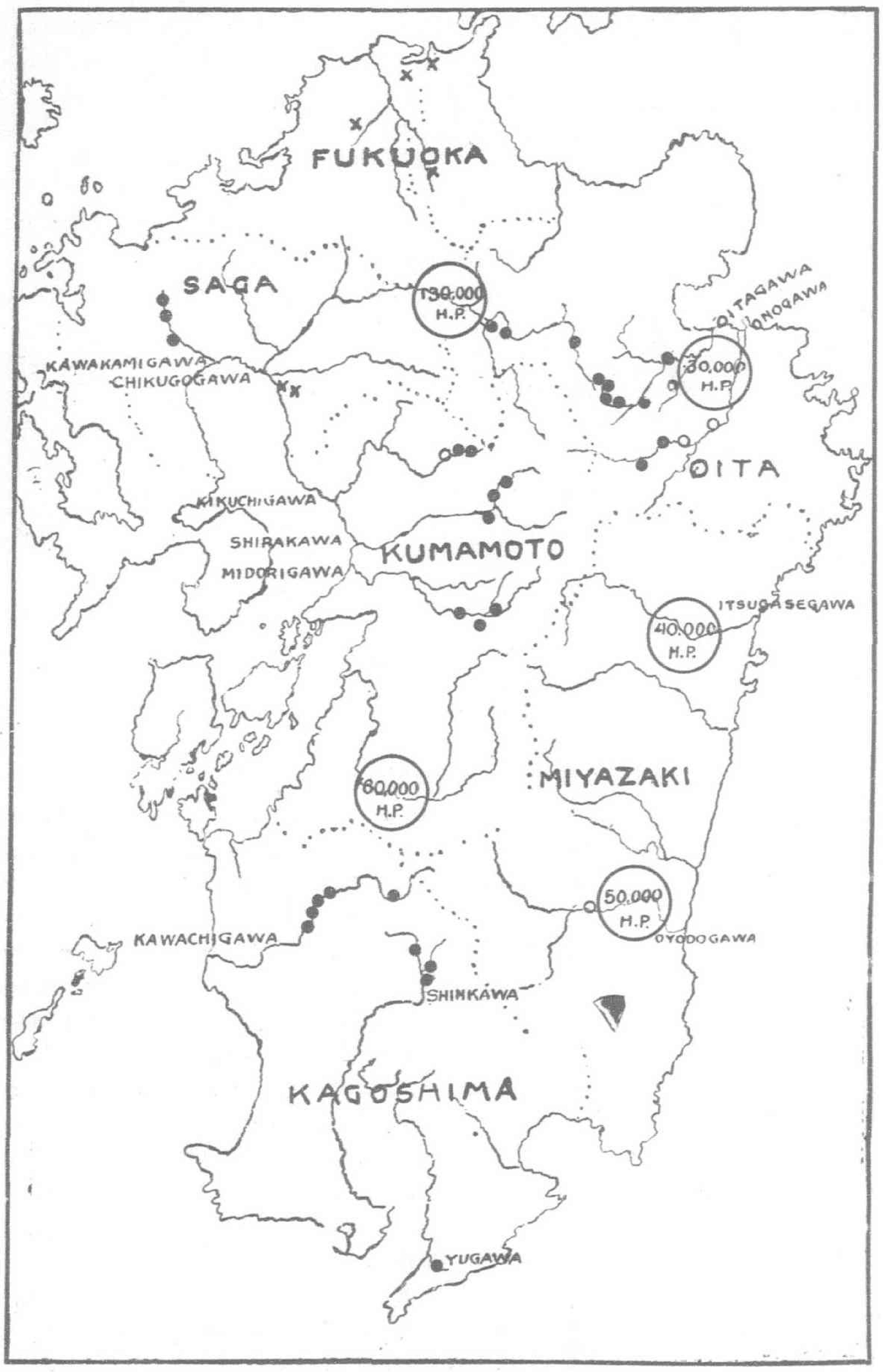
The following rivers capable of supplying power to generate more than 50,000 kilowatts are located in the Chubu, and the Hokuroku, and there are already many stations located on their banks:—

Kisogawa (Chubu)	73 sites.
Jinzugawa (Hokuroku)	42 ,,
Tenryugawa (Tokai)	77 ,,
Oigawa (Tokai)	17 ,,
Shokawa (Hokuroku)	30 ,,
Ibigawa (Chubu)	42 ,,
Kuzuryugawa (Hokuroku)	33 ,,
Yahagigawa (Chubu)	24 ,,
Saikawa (Hokuroku)	42 ,,
Joganjigawa (Hokuroku)	18 ,,

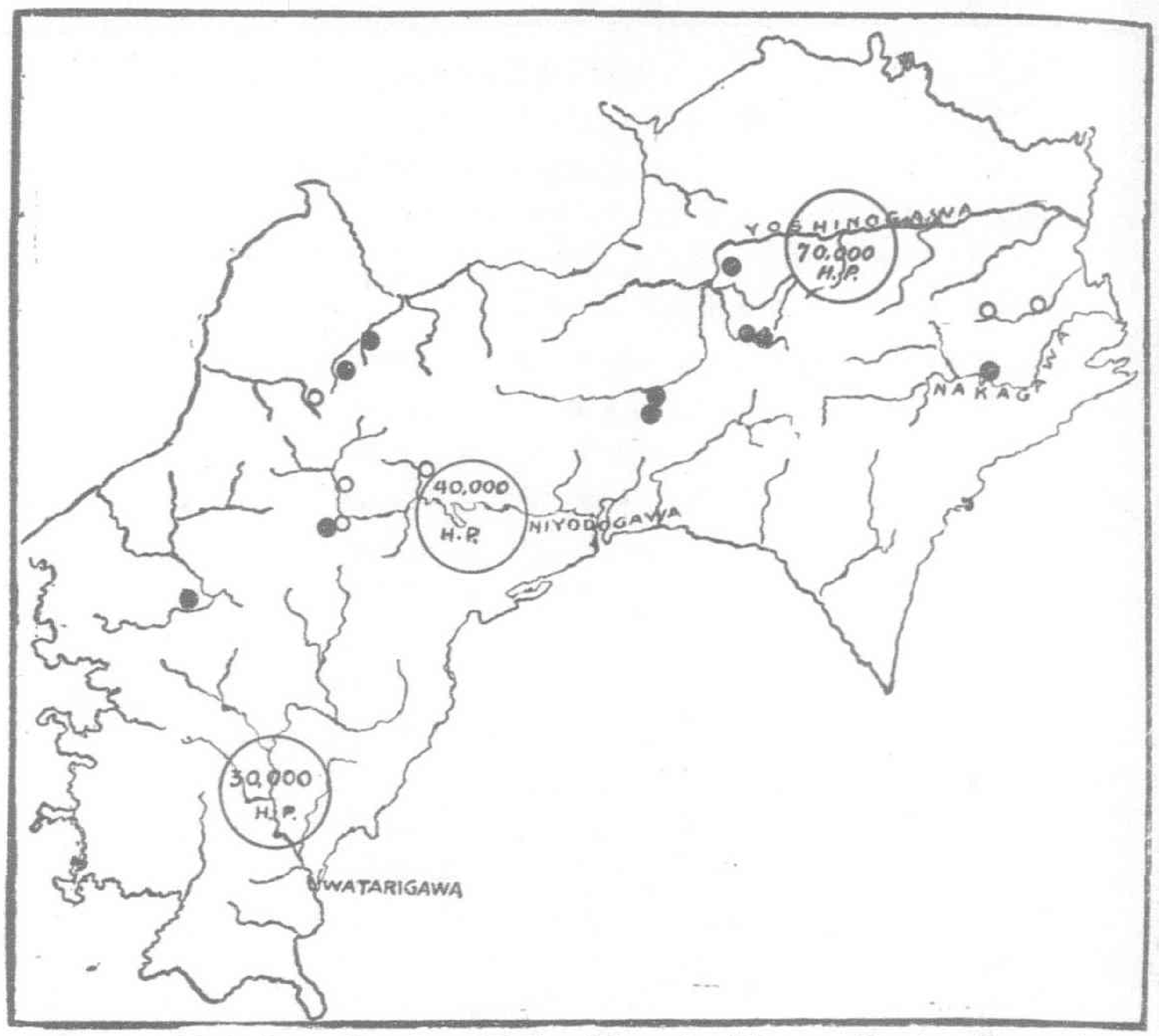
There are also many other small streams having potential power of less than 50,000 kilowatts, which added to those already given will produce 2,000,000 kilowatts, or about 27 per cent. of the total water power resources of Japan.

The important cities of Nagoya, Gifu, Ozaki, Hamamatsu, Toyohashi, Fukui, Kanazawa, and Toyama are all important industrial centres. But despite their potential value as users of power their needs have not assumed any very great proportions yet. Consequently it has not been possible to establish in these three districts, the Chubi, Tokai and Hokuroku, any great power companies having outlets in those cities alone. But now that the needs of Osaka are becoming more and more urgent the great Kansai companies are reaching out into them for power sites, and many plans are being considered for the development of their resources.

In the past few years the Kiso Denki Kogyo, Nihon Suiryoku, Osaka Soden, Nihon Denryoku, have all been established for the purpose of transmitting power to Osaka from these distant places. Excluding the Nihon Denryoku, the Daido Denryoku, with its capital of Y.100,000,000, promoted by the great electric power capitalist, Mr. Momosuke Fukuzawa, has absorbed all these com-



Map of Kyushu, showing Hydro-Electric Plants. ● Plants in Operation, 500 Kilowatts and upward; ○ Projected; X-Steam and Gas Power Plant



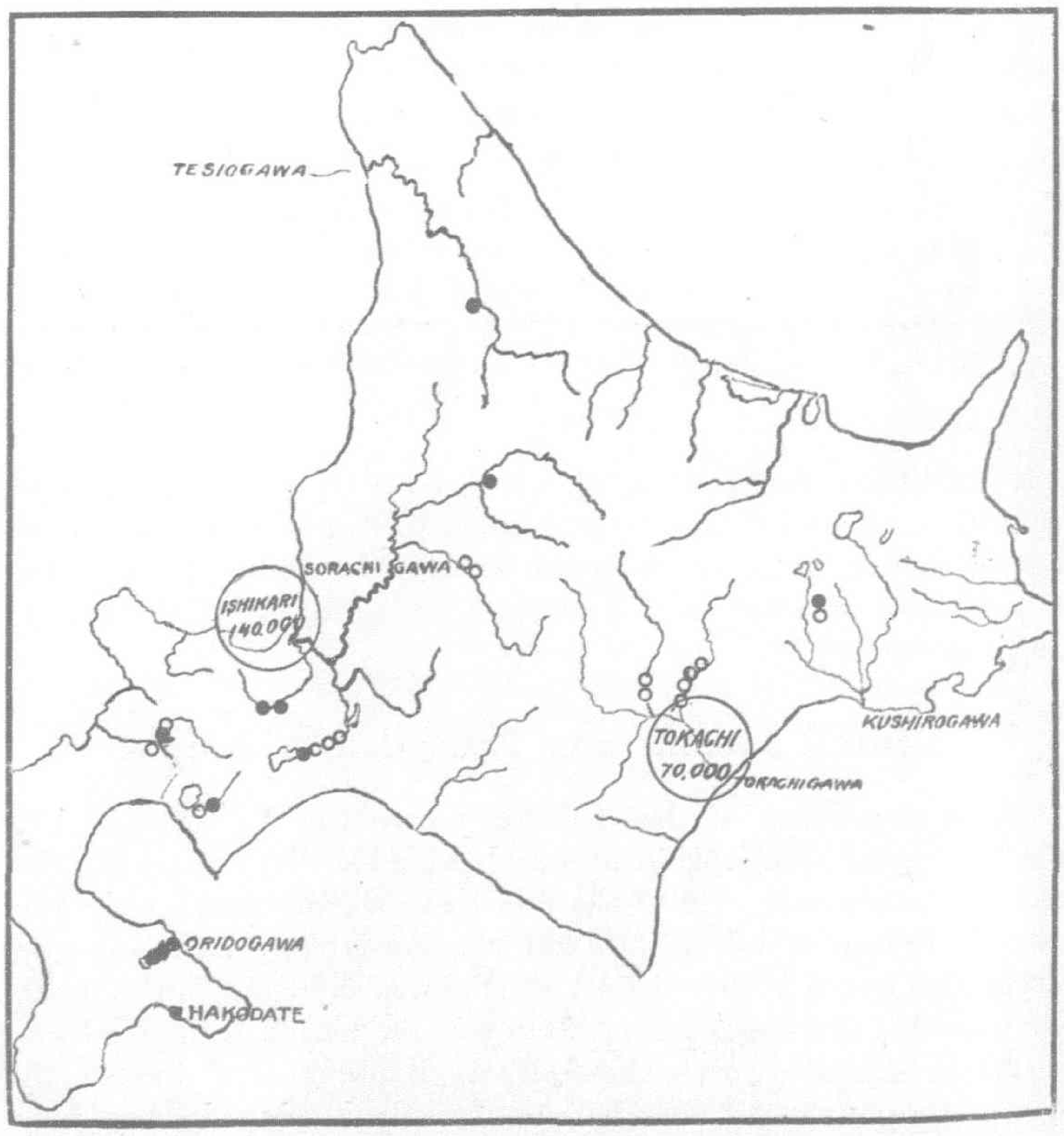
Map of Shikoku, showing Hydro-Electric Plants. ● In Operation, 2,000 Kilowatts and upwards; Projected. ○ In Operation, 500 Kilowatts and under

panies. The Daido has ambitious plans for absorbing other companies and extending its services; it is said that the scope of these plans covers almost all the important industrial centres in Japan. Its power plants to-day are not producing much, only 24,800 kilowatts from the Kisogawa, Yahagigawa, and Kuzuryugawa. But this company has in course of construction power plants on the Kisogawa at Okuwa, and Suhara to generate 20,000 kilowatts, and at Tokushi, Komone and Oi on the Kisogawa, preparations are now being made to construct plants to generate 100,000 kilowatts more.

Scattered here and there through central Japan there are other companies which in the future will be in a position to generate 600,000 kilowatts. Osaka, Nara, Kobe and Wakayama are all in great need of cheap power, and are anxiously awaiting the extension of water power companies in their neighborhoods. It costs Y.12,000,000 to build the necessary transmission lines and stations between the Kisogawa and Osaka, but even this expense is not prohibitive, so necessary is power to these growing commercial centres.

The Kansai Denki and the Daido Dento are in the hands of the same group of capitalists. The Kansai Denki recently amalgamated the Taisho Suiryoku Denki, operating in Nara prefecture, capitalized at Y.10,000,000. The Taisho Denki is planning to build four power stations to generate 19,600 kilowatts on the Kumanogawa in Wakayama prefecture, and on the Yoshino Gawa in Nara prefecture. The Wakayama Suiryoku has also been annexed recently, because it is a particularly valuable organization for the supply of cheap power to Osaka city. It is reported that the Kansai Denki will soon annex the Itatorigawa Denki, the Mino Denki Hiryo, the Tenryugawa Suiryoku and the Yamashiro Suiryoku companies.

In Toyama and Ishikawa prefectures, in the Hokuroku district, there are many sites where enormous power can be developed. The Daido Denki is operating with the greatest success in these prefectures, and because of the capital relation between them the Daido and Kansai companies are now the greatest suppliers of power in central Japan. Perhaps they may even be able to realize their dream of obtaining control of all the important power sites remaining in the districts they are now operating in, and be able to extend their supply boundaries to Tokyo district.



Hokkaido Hydro-Electric Power Plants. ● In Operation, 500 Kilowatts and upward; ○ Projected

The plans for the expansion of these companies include the following distribution stations :—

Sakashita	Transformer	Station	250,000 kilowatts
One	,,	,,	80,000 ,,
Hatotani	,,	,,	100,000 ,,
Funatsu	,,	,,	200,000 ,,
Iida	,,	,,	110,000 ,,
		Total	740,000 ,,
Tokyo	Transformer	Station	100,000 kilowatts
Kozu	,,	,,	20,000 ,,
Hamamatsu	,,	,,	40,000 ,,
Nagoya	,,	,,	100,000 ,,
Kofu	,,	,,	10,000 ,,
Osaka	,,	,,	260,000 ,,

The Sakashita station will operate between Osaka and Nagoya a distance of 137 miles. The Funatsu station between Sabaya and Kaihei, and between Ono and Osaka stations, 212 miles. Between the Funatsu station and Nagoya is 108 miles, and from Sakashita to Tokyo is 187 miles, and from Nagoya to Kozu, 164 miles. From Nagoya to Sakashita and to Funatsu, then to Ono, and to Kozu is 309 miles. Adding all the lesser lines, the total transmission lines of these sister companies will be 1,400 miles long, and will cost Y.55,000,000.

In Toyama prefecture the authorities have been working since the spring of 1921 to bring about an amalgamation of the interests of many of the lesser hydro-electric companies owning power sites in important districts. Not all the companies have taken kindly to the official suggestions, but as a first step in the consummation of the plan the Oiwa Denki, the Fusegawa Suiryoku Denki, and the Aimoto Denki, decided to accept amalgamation with the interests of the Chuyetsu Hydro-Electric Co., capitalized at Y.1,600,000, and which is now, since the amalgamation, the most important water power company in Toyama prefecture. This amalgamation was completed in November, 1921, and it is expected to prove very advantageous to all the companies concerned.

Government Demand for Power in Kansai District

The imperial government department of railways is gradually electrifying its present steam lines and it requires more and more power every year. The whole cost of construction of the line between Tokyo and Kobe, the Tokaido, is estimated at Y.440,000,000. In the eastern part of this line the Tokyo Dento, and in the west the Ujigawa, the Nihon Suiryoku, the Kyoto Dento, and the Daido Denki are all planning future developments to take advantage of the railway's needs.

The railway department plans to electrify all the railways running out of Tokyo city for many miles into the country. The first lines to be constructed will be those between Yokohama, Ofuna, and to Yokosuka, and from Kichijoji to Jacioji, and from Kanda to Chiba, a total of 127.6 miles. There are already in operation in and about Tokyo 58.3 miles of electric railways, government owned.

In the suburbs of Osaka the Joto line, and a part of the Katamachi line, seventeen miles in all, will also be electrified. The total mileage to be converted about Osaka and Tokyo only is 144, and the work, as now planned, is to be completed in 1926. The government's often broached plan to convert the existing trunk line railways to broad gauge has practically been shelved during the past few years by this plan to electrify the principal railway lines.

To operate these 144 miles by electricity a supply of 70,000 kilowatts of power is needed. The Yaguchi power plant supplies 4,500 kilowatts, and the Tokyo city electric bureau, the Tokyo Dento, the Kinugawa Suiryoku, are all together supplying 10,000 kilowatts to the government lines about Tokyo. The line over the Usui Toge, near Karuizawa, gets 2,500 kilowatts from the Yokogawa power plant owned by the government railways. But when these plans for conversion are actually constructed the government railways must be in a position to supply all its own power, without purchasing from outside companies. This will be a blow to some of the plans of the Daido Dento.

The government railways are now completing a coal-burning plant at Akabane, outside Tokyo, which will cost Y.5,000,000 when completed. It will be finished this spring, and will supply 15,000 kilowatts. The railways are also planning the construction of a great 65,000 kilowatts hydro-electric plant on the Shinano river, the largest river in Japan, which will cost Y.45,000,000. If this is completed by 1926 the railway department will have a supply of 84,200 kilowatts of electricity water generated, as well as a coal-burning plant supply of 15,000 kilowatts, a total of 99,200 kilowatts. But only 70,000 kilowatts of water power need be developed, so this plan allows for an excess of 14,000 kilowatts which can be counted on in case of need.

The imperial railway department has completed the plans for the electrification of the Tokaido railway line, between Tokyo and Kobe. All estimates of cost, however, have not yet been made, and it is doubted if it will be possible to present the bill for the approval of this session of the diet.

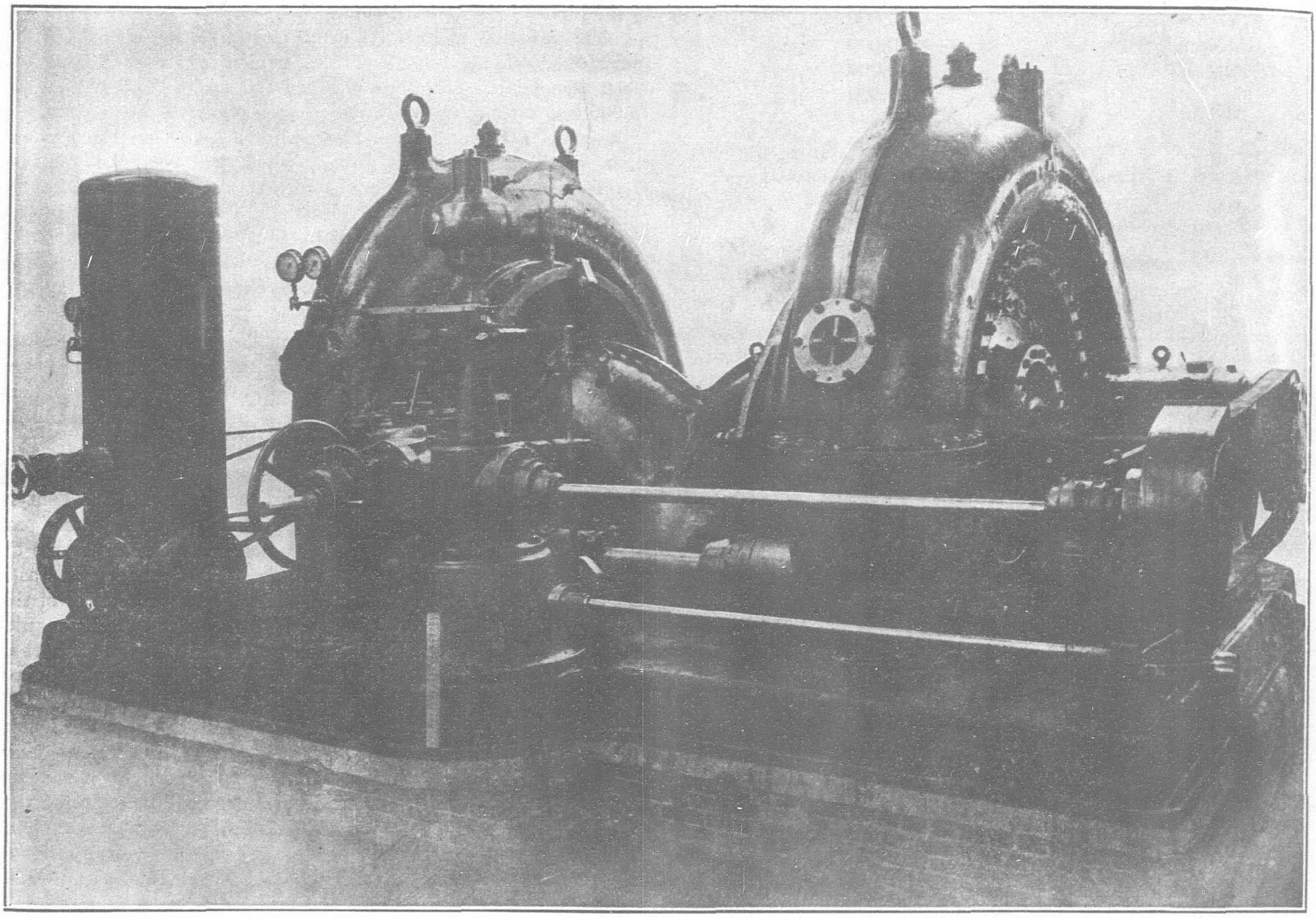
The Daido Denryoku and the Kansai operate very closely with the Tateyama Suiryoku, the Hakusan Denki and the Tenryugawa Suiryoku and as they are all operating in the central part of Japan, despite the fact that they are not included in one organization they are able to work to each other's advantage as if they were. The Ujigawa Denki is the only real competitor of this formidable line of the Daido Denki, and it is in the most advantageous position of all companies in the Kansai, Osaka district to supply power cheaply. It is closely related to the Nihon Denryoku, in which it has invested a greater part of the capital. The Nihon Denryoku is not such an ambitious project as the Daido, but it is closely allied with the Ujigawa, which might well be called its parent company. It is always improving its equipment, machinery, power plants, and transmission system, and it is expected that its new power station on the Takehara River will be completed some time this year. For some time it has been using the transmission lines belonging to the Ujigawa between Osaka and Ozaki, but when its new power plant is completed it will send 5,000 kilowatts of its own power over its own lines now being erected.

The Ujigawa Denki is naturally endeavoring to meet the threatened competition of the Daido Denki, and the relations which it has established with other companies recently have greatly increased its power. But compared to the powerful array of companies swallowed up by the ever-growing Daido last year, the Ujigawa is almost a negligible quantity in the power market, despite the excellence of its management. It generates 74,600 kilowatts to-day, only a little more than that of the Daido group, and when the new plans of the Daido are finally put into operation the Ujigawa's power supplies will be quite eclipsed. Defeated from the outset in the competitive race by number of alliances and power procurable, the Ujigawa Denki is expected to turn its attention to the quality of its service, endeavoring by the excellence of its equipment to meet competition with its more powerful rival. It is reported that the Ujigawa in pursuance of this idea will soon put all its lines underground, and it has already sent many experts abroad to study methods by which the company's equipment and service may be improved.

One of the latest power enterprises to be organized to operate in the central part of Japan is the Nohi Denryoku Kabushiki Kaisha, (Mino-Hida Electric Power Co., Ltd.), established in the spring of 1921. It operates in the provinces of Mino and Hida in Hokuroku district, under the jurisdiction of Gifu prefecture, and it owns many valuable power sites along the rivers in these two provinces. Its authorized capital is Y.3,000,000, and Y.750,000 has already been paid up. A power plant is now being constructed at the village of Neo on the No River, a branch of the Nagara River, 22 miles out of Gifu city. A 7,200-ft. long ditch is being excavated with a fall of 266-ft., which theoretically should generate

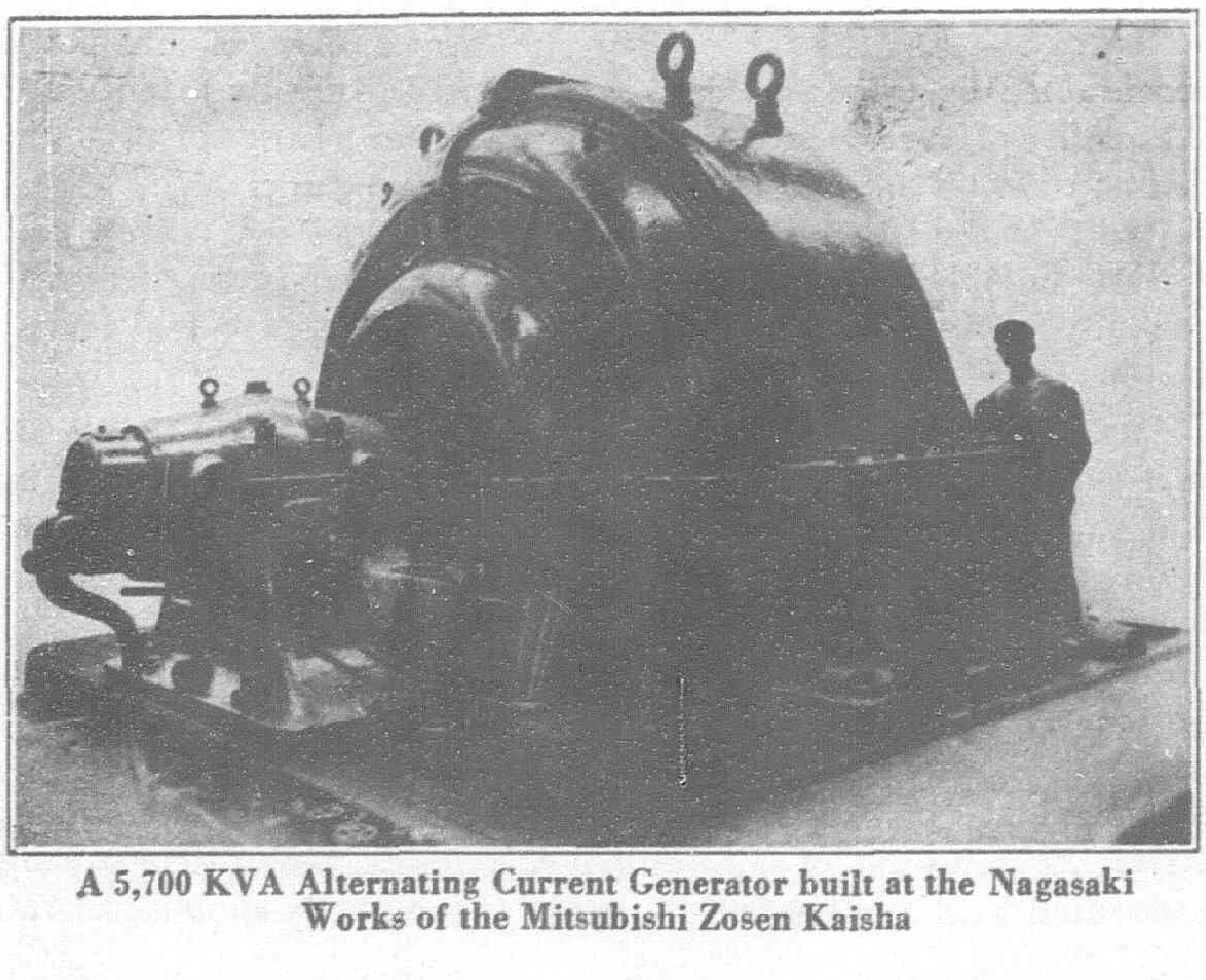
MITSUBISHI ELECTRICAL MACHINERY INSTALLED IN JAPAN

Made by the Mitsubishi Dockyard and Engineering Works at Nagasaki

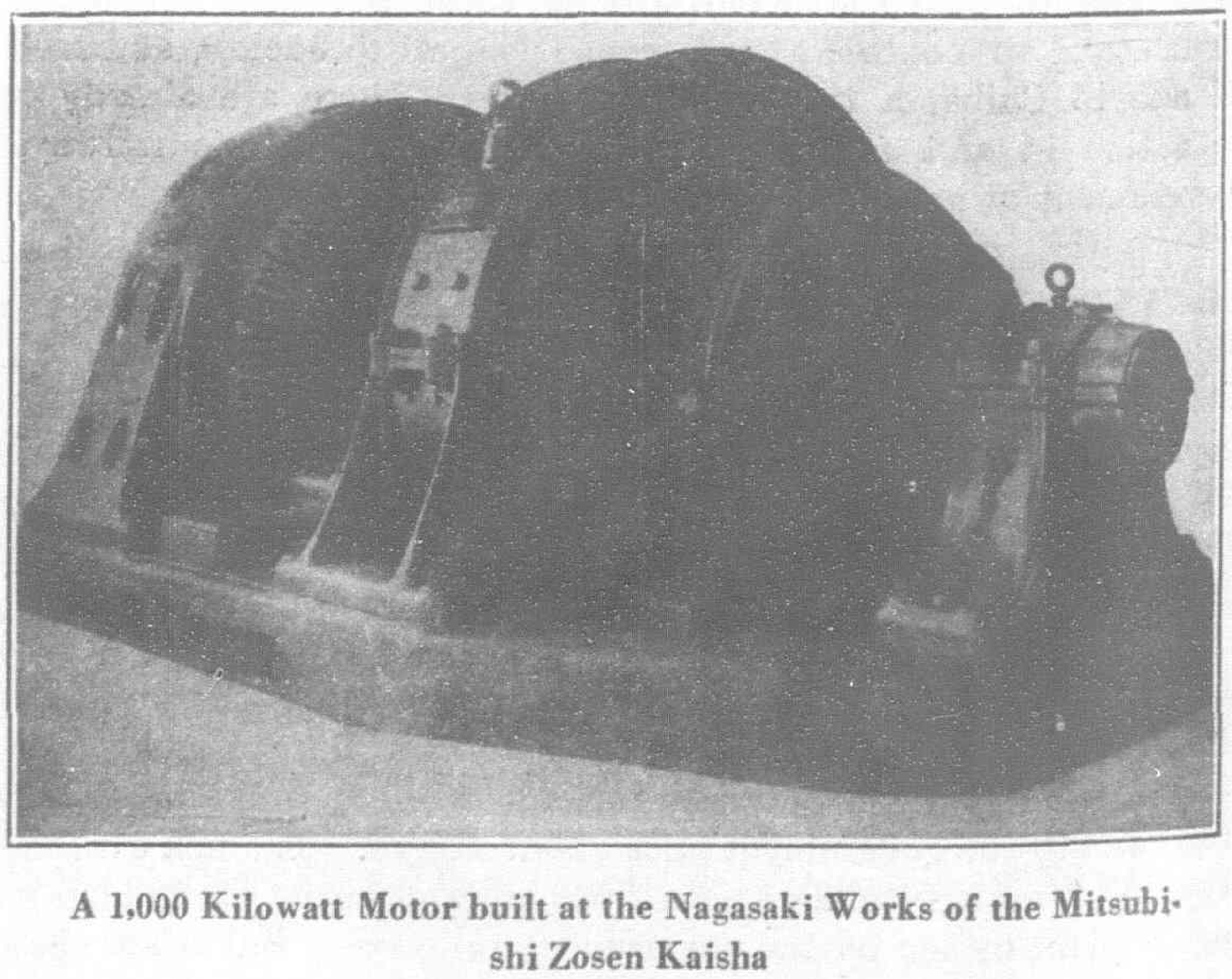


A 10,500 H.P. Francis Water Turbine built at the Kobe Works of the Mitsubishi Zosen Kaisha (Mitsubishi Dockyard & Engineering Works)

4,000 kilowatts. The estimate of construction costs was Y.1,700,000, which brings the cost per kilowatt generated up to Y.560, estimating net production of power at 3,100 kilowatts. The usual estimate for construction to-day is Y.1,000 per kilowatt, so this is expected to be in a very fortunate position to supply power at very cheap rates, a much needed condition of affairs in the industrial world to-day. The promoters of this company are the directors of the Kansai Denki K.K., and although no power contracts have been entered into between them, it is reported that the Nohi will sell all its supply to the Kansai and its co-operating concerns at a price which guarantees 12 per cent. dividends on the Nohi's capital. The paid-up capital is not sufficient to build the power house planned. But as dividends of 12 per cent. must be paid to attract capital to shares, and debentures can be issued



A 5,700 KVA Alternating Current Generator built at the Nagasaki Works of the Mitsubishi Zosen Kaisha



A 1,000 Kilowatt Motor built at the Nagasaki Works of the Mitsubishi Zosen Kaisha at 8 per cent., it is likely that the balance of the costs of construction will be covered by an issue of debentures.

Chugoku and Shikoku Districts

In these districts, Chugoku, south of Kobe along the Japan Sea, and the Inland Sea to Shimonoseki, and Shikoku, the island south of Kobe, there are very few rivers with swift currents. There is not one river in the whole district which will develop 100,000 kilowatts. So it is impossible to build large power stations. Demand for power too, is also very scattered, and is not concentrated in any one locality. Consequently the electric power projects are not located around any one city, such as is the case in the Tokyo and Osaka districts. This condition has acted as a deterrant to the amalgamation of existing companies on a very large scale, as it has acted against amalgamations in the Chubu and Hokuroku.

The Okayama Suiryoku Denki K.K. and the Susaki Denki K.K. were recently amalgamated under the name of the Chugoku Suiryoku Denki K.K. The Himeji Suiryoku bought up four small concerns in recent months, and the Hiroshima Dento and the Hiroshime-Kure Denryoku were also amalgamated under the name of the Hiroshima Denki K.K. Several other small companies with capital of less than Y.100,000 have also effected amalgamations of their interests. But all the big changes in company organizations have been centred around the towns, Himeji, Okayama, Hiroshima and Matsue.

In the Chugoku district the lines of water power supply are concentrated around (1) Himeji, drawing power from the Takakawa, the Ibigawa and the Chukusagawa, potentially generating 18,000 kilowatts; (2) Okayama drawing water from the Yoshigawa, Asahigawa and the Koryogawa, potentially capable of generating 30,000 kilowatts and (3) Hiroshima with potential supplies of 58,000 kilowatts developed from the Otagawa, Iwakunegawa and Osegawa.

The Sanin and Sanyo districts located along the Japan sea and near Shimonoseki on the Inland Sea, have very small water power resources. The city of Tottori on the Karogawa, has potential power of 23,000 kilowatts at its disposal, and Matsue can develop 42,000 kilowatts from the Hiigawa, Kanbegawa and the upper stream of the Gonogawa.

Shikoku

There is very little water power to be developed in Shikoku. In Tokushima prefecture there are 73,000 kilowatts to be developed on the upper stream of the Yoshinogawa, and in Kochi prefecture, 45,000 kilowatts can be obtained from the Niyodogawa.

To-day the most important companies operating in Shikoku are (1) Tokushima Suiryoku Denki in Tokushima city, capitalized at Y.6,000,000, developing 1,500 kilowatts from water, and 1,800 kilowatts from coal; (2) Shikoku Suiryoku, in Tadotsu city, capitalized at Y.5,030,000, developing 3,850 kilowatts from water and 1,500 from coal; (3) Iyo Denki Tetsudo (electric railway), capitalized at Y.4,600,000, generating 1,460 kilowatts from water and 1,000 kilowatts from coal; (4) Ehime Suiryoku in Imahara, capitalized at Y.10,000,000, generating 1,980 kilowatts from water power alone; (5) The Kochi prefecture water power electricity business office, in Kochi prefecture, capitalized at Y.1,245,000, developing 2,430 kilowatts from water. The total power generated from water is 12,220 kilowatts, and from coal 4,300 kilowatts.

The Tokushima Suiryoku recently increased its generating plant equipment in Sakura by 2,000 kilowatts, and on the Jinzagawa by 600 kilowatts, and on the Igagawa by 6,000 kilowatts, and its coal power station in Komatsu by 1,000 kilowatts, a total of 9,400 kilowatts in all. At Naruto Straits, the cable station supplied power to the Awaji-Sumoto mills of the Kanegafuchi Cotton Spinning Mills.

Kyushu

Kyushu is one of the centres of the coal mining industry in Japan and the water power resources of that island have not yet been extensively developed.

The more important companies in Kyushu are: (1) Kyushu Suiryoku Denki, in Fukuoka city, generating 59,902 kilowatts from water and 14,865 kilowatts from coal. It has under construction an extension of its water power plant amounting to 15,000 kilowatts; (2) Kyushu Dento Tetsudo (electric light and railway) in Fukuoka city, generating 10,600 kilowatts from water and 30,065 kilowatts from coal; (3) The Kumamoto Denki, in Kumamoto, generating 18,800 kilowatts from water power; (4) The Denki Kogyo Gasu in Kagoshima, generating 1,000 kilowatts from water and 1,760 kilowatts from coal; (5) Nihon Sanso Hiryo (fertilizer company) in Oita generating 29,815 kilowatts from water. All these companies own many valuable power sites not yet developed.

The more important coal mining companies of Kyushu all have their own power plants to use for their own operations, but the Sumitomo, Mitsui and Mitsuibishi interests supply power from their stations to the surrounding districts.

The rivers of Kyushu are capable of developing the following powers :—

Chikugogawa ...	29 sites,	132,442 kilowatts
Oitagawa	12 ,,	34,614 ,,
Onogawa	10 ,,	39,789 ,,
Shiratsuwagawa ...	4 ,,	48,790 ,,
Midorigawa	14 ,,	61,306 ,,
Oyodogawa	22 ,,	55,595 ,,
Gokasegawa	16 ,,	43,401 ,,
Sendaigawa	10 ,,	3,911 ,,

The principal distributors are the Kyushi Suiryoku, and the Kyushu Denki Tetsudo, which at the suggestion of the imperial railway department are planning to unite their interests.

The Kyushu Dento Tetsudo, Kyushu Suiryoku Denki, Kyushu Denki Kido, and the Kumamoto Denki are planning a big amalgamation under the name of the Kyushu Soden K.K. (Kyushu General Eelectric Co.) It is planned to develop the potential power of Miyazaki prefecture in south-eastern Kyushu, and to transmit power to the industrial district around Moji. But there are many difficulties in the way of successful operation in Miyazaki prefecture, particularly because the laws of the prefecture permit the authorities to levy a tax on power generated in the prefecture when it is sent to other districts.

Hokkaido

The most important power resources of the Hokkaido are :—

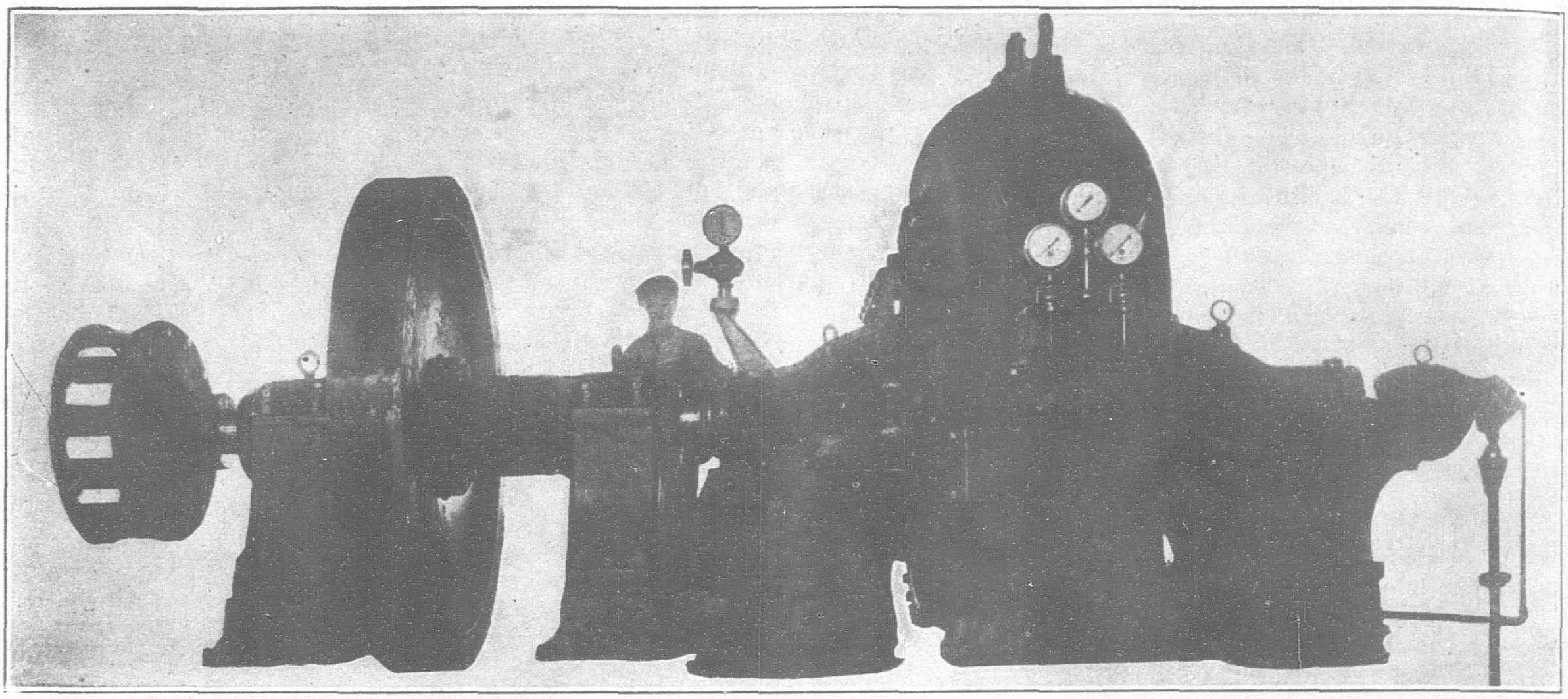
Ishigarigawa	144,000 kilowatts
Shiribeshigawa	27,000 ,,
Togachigawa	96,000 ,,
Kushirogawa	30,000 ,,

All these are in the northern part of the island, where there is but little development of population and industry. Even in the south there is little demand for power. In the southern part of the island the Oushi and Nagara rivers have considerable potential power. In the neighborhood of Hakodate the Hakodate Suiden develops power from the Oritogawa, and the Shiribeshi Denki develops power on the Shiribeshigawa, and a branch of the Ishigarigawa. There are many small companies all over the Hokkaido, the Fuji Denki, Sapporo Suiryoku and Oji Seishi, the Nitsui Kozan, etc., but no amalgamation of interests so scattered has been made. Other mines and industrial companies have their own power stations, and the only company making any attempt at concentrating power interests is the Teikoku Dento which finds in the Hokkaido one of the most prosperous districts of its operations.

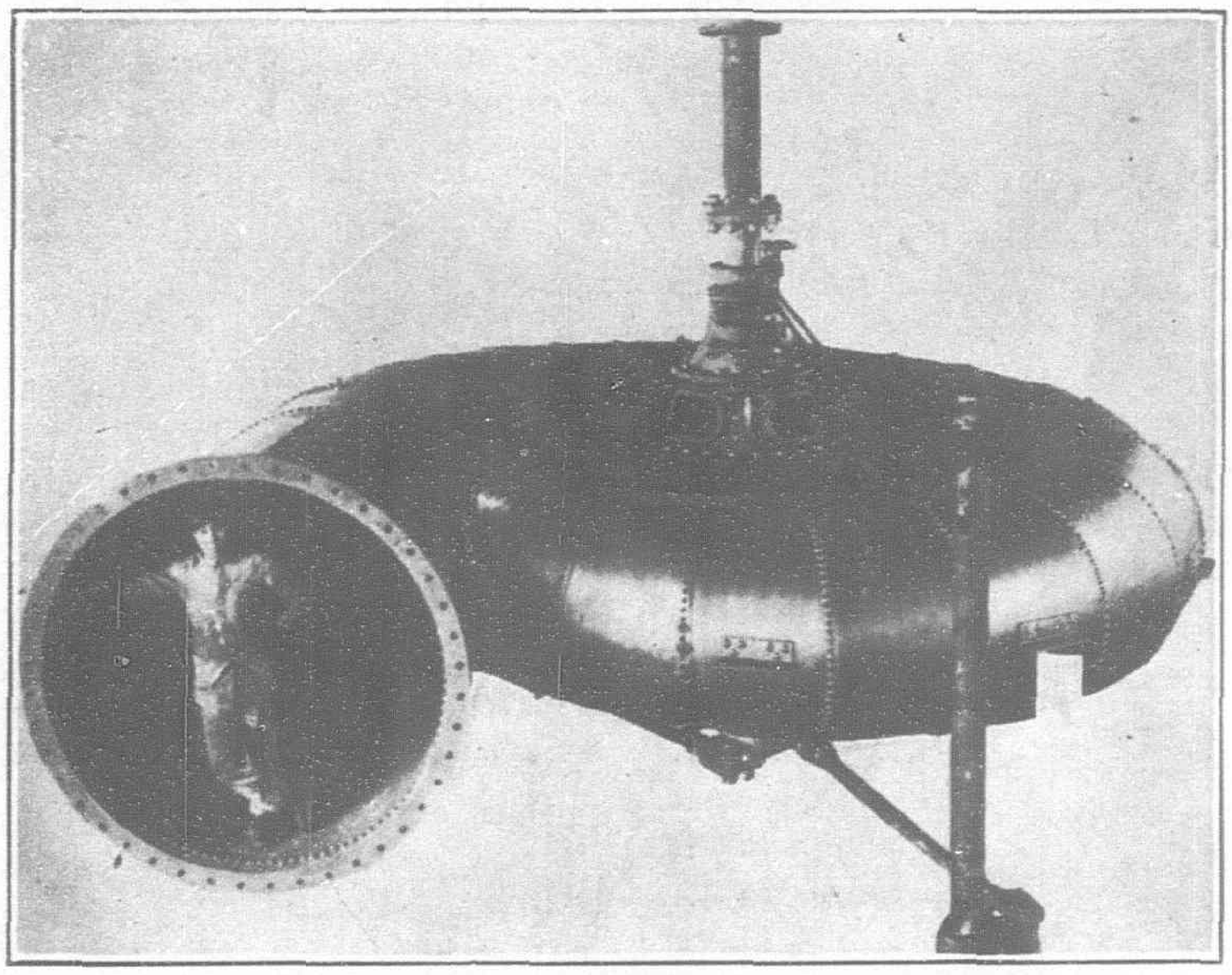
Hydro-Electric Power in Kyushu

During the period of war prosperity there was a great increase in the number of factories established in Kyushu. To furnish the power for many of these factories great strides were made in developing water power resources in that island. At the end of 1914 there were only 101,061 kilowatts developed by hydro-electric, coal and gas plants. According to an investigation of the depart-

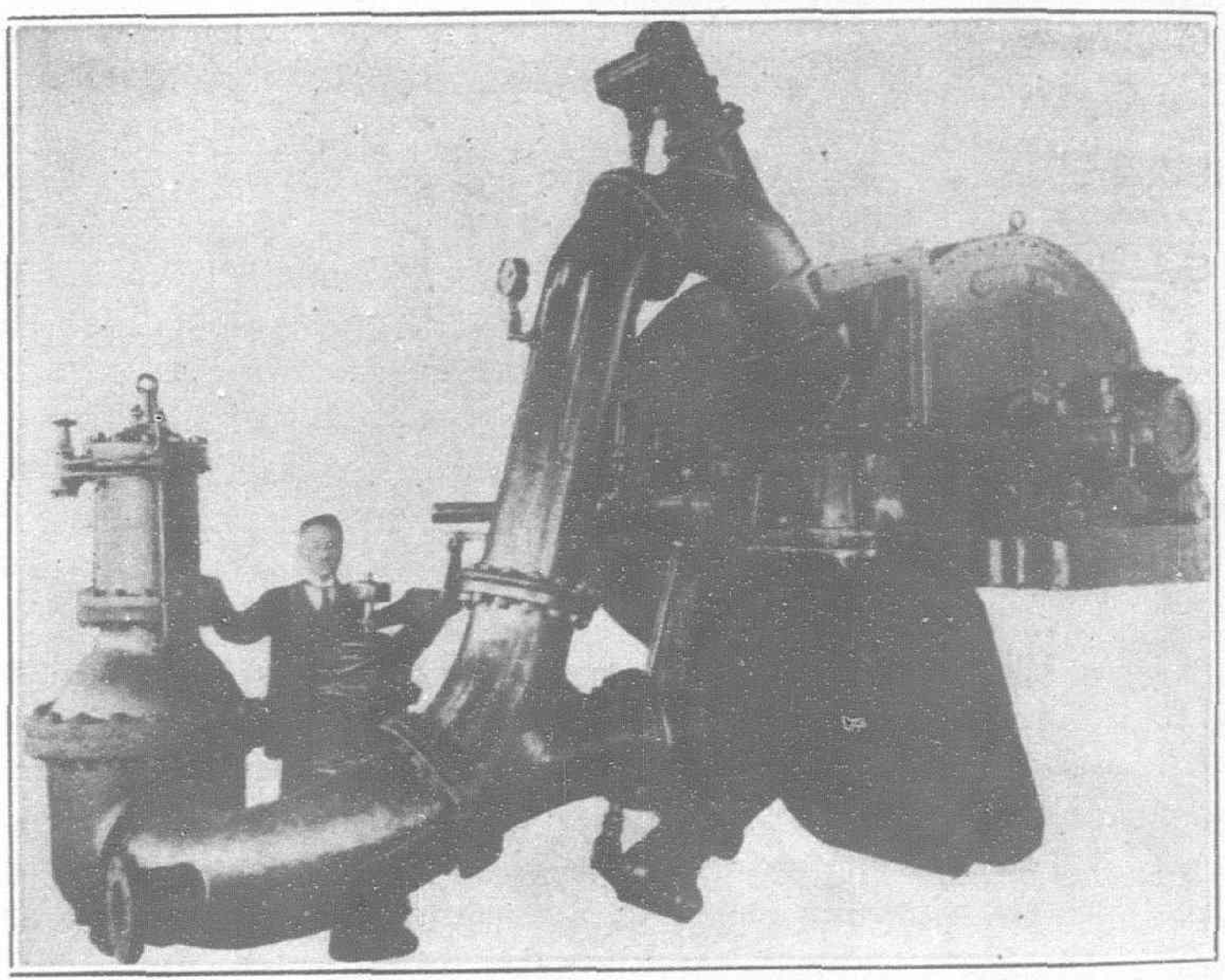
HYDRO-ELECTRICAL EQUIPMENT MANUFACTURED BY THE HIDACHI ENGINEERING WORKS LOCATED AT SUKEGAWA, IBARAKI PREFECTURE, JAPAN



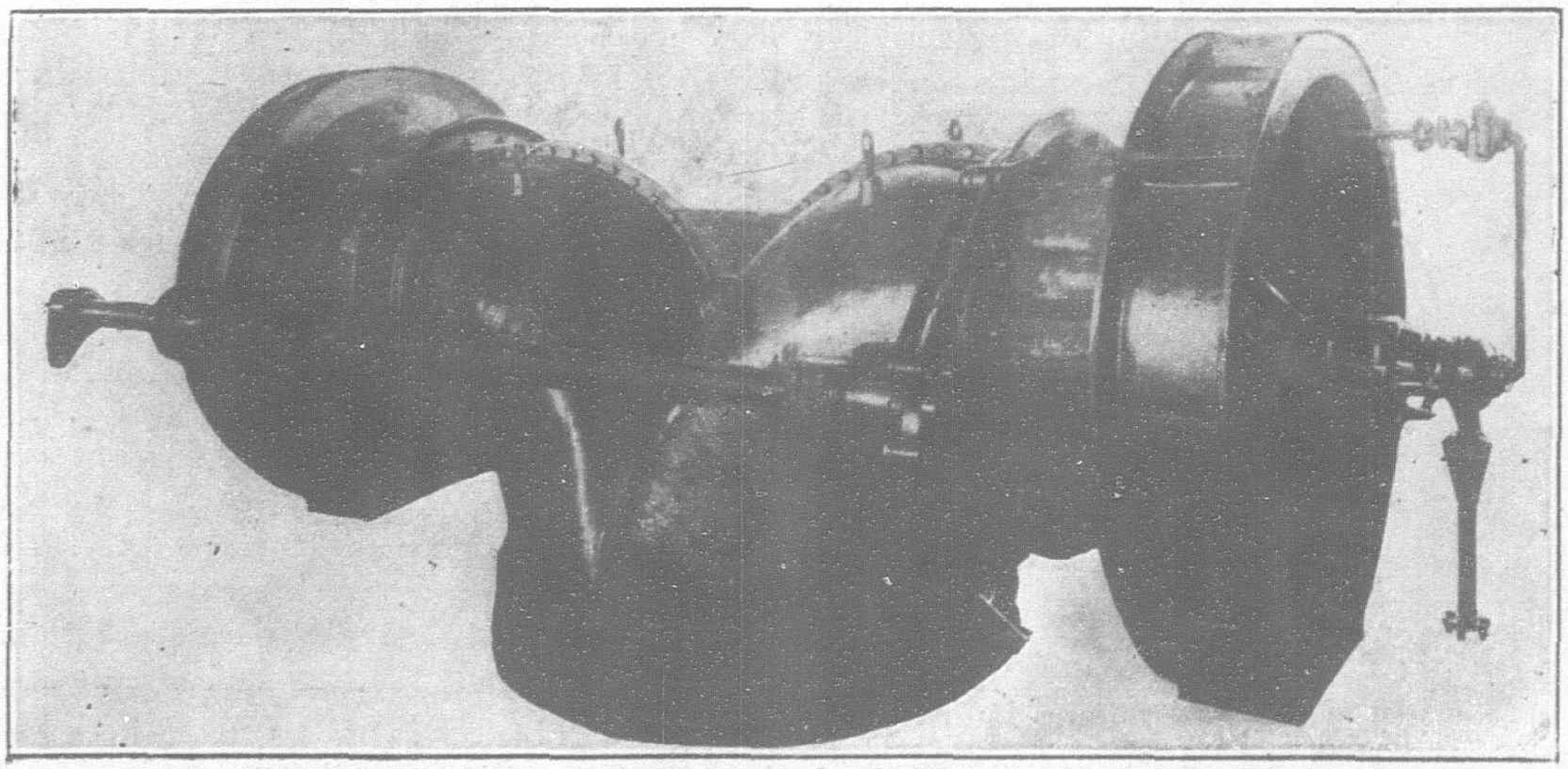
A 2,400 F.D.S. Water Turbine Manufactured by the Hidachi Engineering Works for the Sanyo Hydro-Electric Company



A 1,500 H.P. V.F.S.S. Water Turbine built by the Hidachi Engineering Works for the Shidzuoka Hydro-Electric Company



A 2,400 H.P. Nozzle Pelton Water Wheel made by the Hidachi Engineering Works for the Sanyo Hydro-Electric Company



A 750 H.P. F.D.O. Water Turbine made by the Hidachi Engineering Works for the Mannose Hydro-Electric Company ment of communications, these three sources of power by April 1920 had developed 465,147 kilowatts. Of this amount 234,584 kilowatts were developed from water power plants, 207,774 kilowatts from coal, and 2,789 kilowatts from gas burning plants.

Between April 1, 1920, and March 31, 1921, a tremenduous increase to O.K. place in the amount of capital invested in electric power plants in Kyushu. On March 31, 1921, the authorized capital of all projects in Kyushu was Y.153,380,000, of which Y.94,250,000 was paid up. This represented an increase af Y.51,590,000 in nominal capital, and of Y.25,980,000 in paid-up capital since April 1, 1920.

One of the conspicuous features of the electric power industry in Kyushu during the period April 1, 1920-March 31, 1921, was the great decrease in the demand for power from the users of large quantities, and the very marked increase, on the contrary, of the number of small users. The almost total suspension of business by many chemical companies and mining concerns so prosperous during the war caused this decrease in demand for large quantities. On March 31, 1920, there were 6,410 electric motors used by 6,612 concerns, consuming 175,000 kilowatts, but at the end of March, 1921, there were 8,538 motors, used by 7,027 concerns, consuming only 109,524 kilowatts. This decrease is entirely due to the closing of many large factories because of the difficulties of continued financing. Even blacksmiths and carpenter shops have entered the ranks of users of small amounts of power, and there is no doubt whatever that this change in the class of users is a healthy sign of the return of peace conditions, and a modernization of the ideas of small machine shop owners.

Four companies control the most important hydro-electric power of Kyushu, the Kyushu Denki Kido Kaisha, Kyushu Dento Tetsudo Kaisha Kyushu Suiryoku Kaisha, and the Kumamoto Denki Kaisha. These four companies also have controlling interests in all the other electric companies of Kyushu.

While the use of electric power by manufacturing concerns has decreased, there has been a steady increase in the use of power for lighting. At the end of March, 1920, one house in Kyushu burned 2.3 lights of 16 c.p. each, from sunset to sunrise. By the end of March, 1921, this had increased to 4.48 lights. The use of electric lights has little appreciable connection with financial conditions, for their use is a development of the blessings of peace. The use of electric power in factories, is, however, in quite a contrary position, being utterly dependent on the financial condition of the country.

The average cost of burning one 16-candle power light from sunset to sunrise for one month in Kyushu is Y.1.057. The meter charge per kilowatt is 20.2 sen. The Osaka Dento Kaisha charges Y.0.555 for the same light, 16 c.p. and the same service. There is a reason for this in the greater cost of equipment in Kyushu, where one pole carries only two or three lights, while the Osaka equipment carries more than 100.

Power contracts are usually individual, so it is very difficult to arrive at the actual cost of electric power in Japan.

There has been a great growth in the amount of power generated by hydro-electric power plants since 1920. But in 1921 power from hydro-electric plants was more expensive than power from coal and gas-burning plants. The price of coal was low in 1921, and it had a very bad effect on the water power companies in Kyushu. If coal remains at its present low price the future development of the hydro-electric power business in Kyushu will be greatly threatened. Not only in Kyushu is the industry threatened, but in other parts of Japan as well. In the Osaka district the price of coal fell to 70 yen per 10,000 *kin* (13,333-lb., 3 6 2/3 tons of 2,000-lb.) If it falls lower than this hydro-electric plants can no longer supply power at cheaper rates than coal burning plants. Just now the price of coal is falling below 70 yen, and the hydro-electric interests are not at all unreasonably concerned about the future of their business. To protect themselves in all emergencies the four Kyushu companies already mentioned are planning to combine their interests.

The background of the Kyushu electric world is composed of Baron Kichiyemon Sumitomo, Mr. Wada Toyoji, and Mr. Momosuke Fukazawa. These three men are planning the organization of the Kyushu Soden Kaisha (The Kyushu General Electric Co., Ltd.), with a capital of Y.30,000,000, which they will later increase to Y.200,000,000. It plans to exploit the unworked resources of Miyazaki prefecture in the south-east of Kyushu.

Miyazaki prefecture possesses most of the undeveloped water power resources of Kyushu. Many proposals have been made from time to time to utilize these resources, but the inhabitants have always violently opposed any exploitation of the prefecture's power unless it is used entirely within the prefecture. This is nonsense, but the people complain that if the power is monopolized by a company like the Kyushu Soden Kaisha, they will be charged anything the company pleases for the power they will use. But actually the Kyushu Soden would serve to smooth out the inequalities in the present service. Power could be switched from one locality to another as plants are laid off because of low water supply, and when necessary power could be turned on from coal-burning plants. The cost of new lines would be greatly economized, and it is now reported that despite the protests of the people of the prefecture, the company will be organized, and that it will eventually exploit the resources of Miyazaki prefecture's streams.

It has been estimated that it will cost Y 550 to develop one kilowatt in Miyazaki prefecture. It is 180 miles from Miyazaki to north Kyushu where most of the power will be used. To send power 180 miles is rather an expensive proceeding, so that altogether the cost of power from Miyazaki prefecture will not be very cheap. The capital of Y.30,000,000 planned for the new General Electric Company of Kyushu, is not sufficient to meet all the demands the construction will make on it, so it will probably be necessary to increase this capital to Y.200,000,000 before actual work is commenced.

The Kyushu Electric Light and Railway Company, which supplies Nagasaki with electric light and power will shortly enter into a contract of amalgamation with the Kansai Electric Company of Nagoya. The capital of the Kyushu company is Y.50,000,000 of which Y.24,312,500 is paid-up. The Kansai company is capitalized at Y.73,389,000, of which Y.52,783,441 is paid-up. The capital of the new company which is to absorb these two companies will be Y.121,989,600.

The Kyushu company obtains most of its power from coal plants, and the Kansai from water power. The Kyushu company needs funds to build hydro-electric stations in Miyazaki prefecture, and an electric tramline between Omuta and Fukuoka, which will require Y.20,000,000 at least. The Kansai company wishes to obtain the services of the Kyushu company's directorate, and as the two companies are capitalized by the same individuals the amalgamation was more or less a matter of course.

The Teikoku Dento Kabushiki Kaisha

(THE IMPERIAL ELECTRIC LIGHT CO., LTD.)

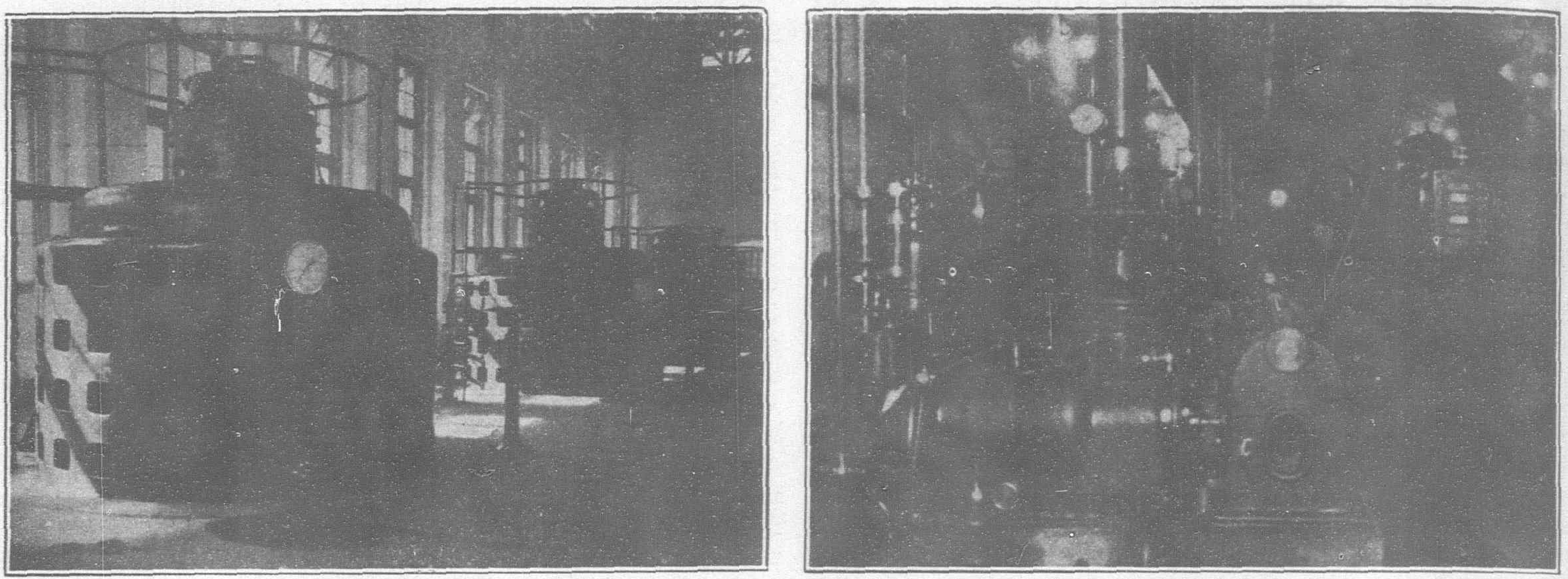
A Typical Example of Electric Lighting Expansion

One of the most important movements in Japanese industry and finance is the absorption of small water power companies by larger concerns, affecting a concentration of power facilities in the important industrial districts.

The Teikoku Dento K.K., however, is the only concern of its kind specializing in concentrating electric light companies under its control. It is ten years since it was first organized with the object of investing in sound electric light projects in country districts. During the years of its operations its methods of business have undergone constant change, and its policy of expansion in all profitable directions has eventuated in a scheme of concentration of lighting facilities through amalgamation with small companies operating in and about its special territories.

In its beginnings there were no particularly well defined plans formulated for concentration, but as the demand for electric light continually expanded well defined lines along which a concentration

SWISS TURBINES IN JAPAN FROM THE WORKS OF ESCHER, WYSS & COMPANY



4-9,600 H.P. Turbines installed in the Power House of the Katsuragawa Hydro-Electric Company

of operating interests could profitably be undertaken were developed. The Teikoku Dento was a pioneer, if not the only enterprise, in the field of electric light expansion in the less densely populated districts. The company operates from three centres, controlling, or owning outright, groups of companies supplying the geographical districts covered from these centres: (1) Vicinity of Tokyo, country districts (The Kwanto); (2) Tantan District, north of Kyoto; (3) Hokkaido.

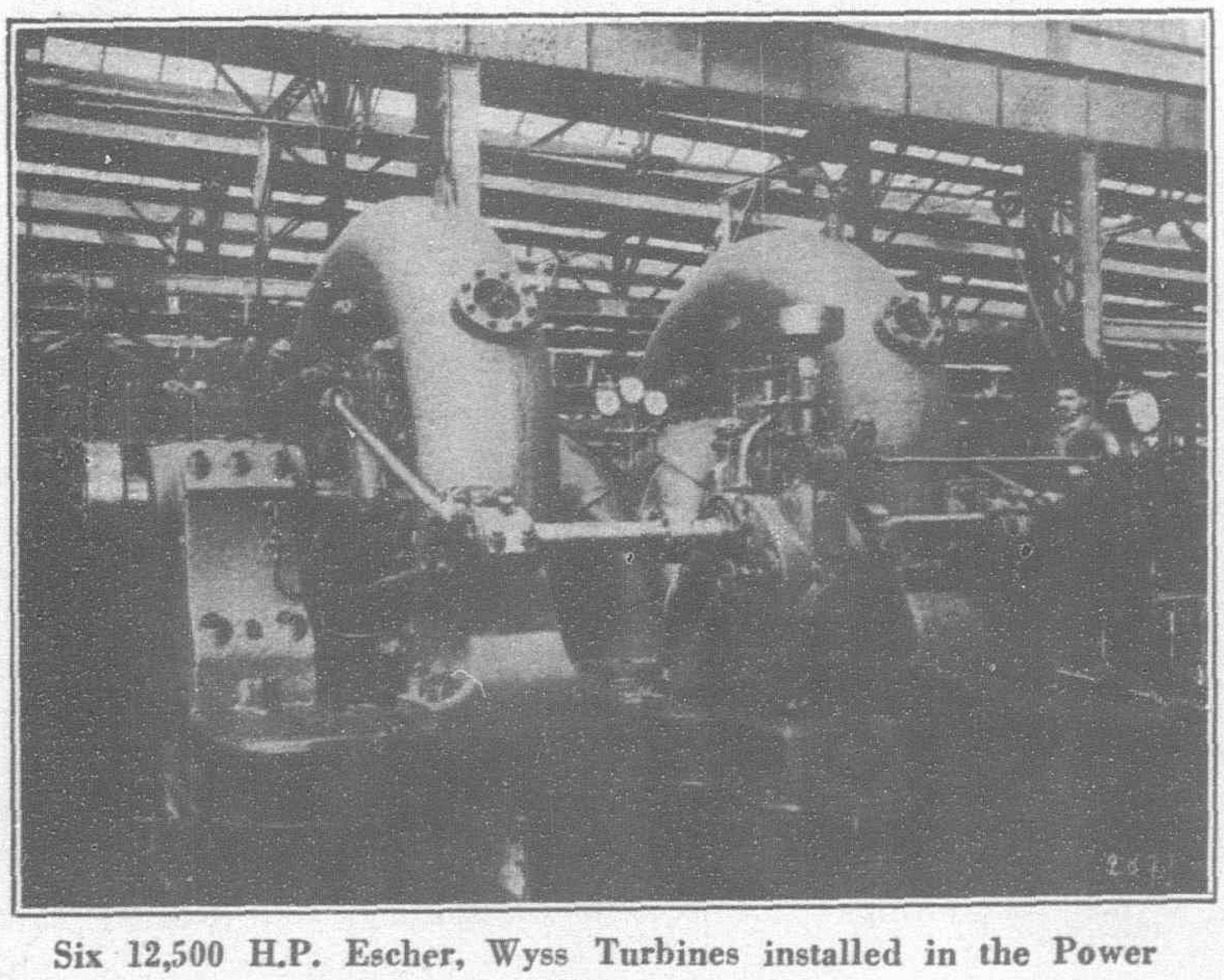
The greatest strength of the company is concentrated around Tokyo, where it has recently been strengthened by absorbing the Shimotsuke Denryoku Kabushiki Kaisha (Shimotsuke Electric Power Co., Ltd.), referred to in detail further on. Following this amalgamation, the Teikoku Dento completely reorganized its business and as a consequence it has now become a new and forceful factor in the electric power field in the Kwanto district (eastern Japan with Tokyo as the centre).

On October 1, 1921, the Teikoku Dento annexed the Santan Denki Kaisha capitalized at Y.5,000,000 and doing business at Toyooka Machi, in Hyogo prefecture. The Santan paid a dividend of 10 per cent. in September 1921, but owing to lack of capital it was found difficult to develop its business to keep in touch with the growth of the district in which it operates. The Teikoku at once took advantage of this opportunity to get into the Osaka-Kobe territory.

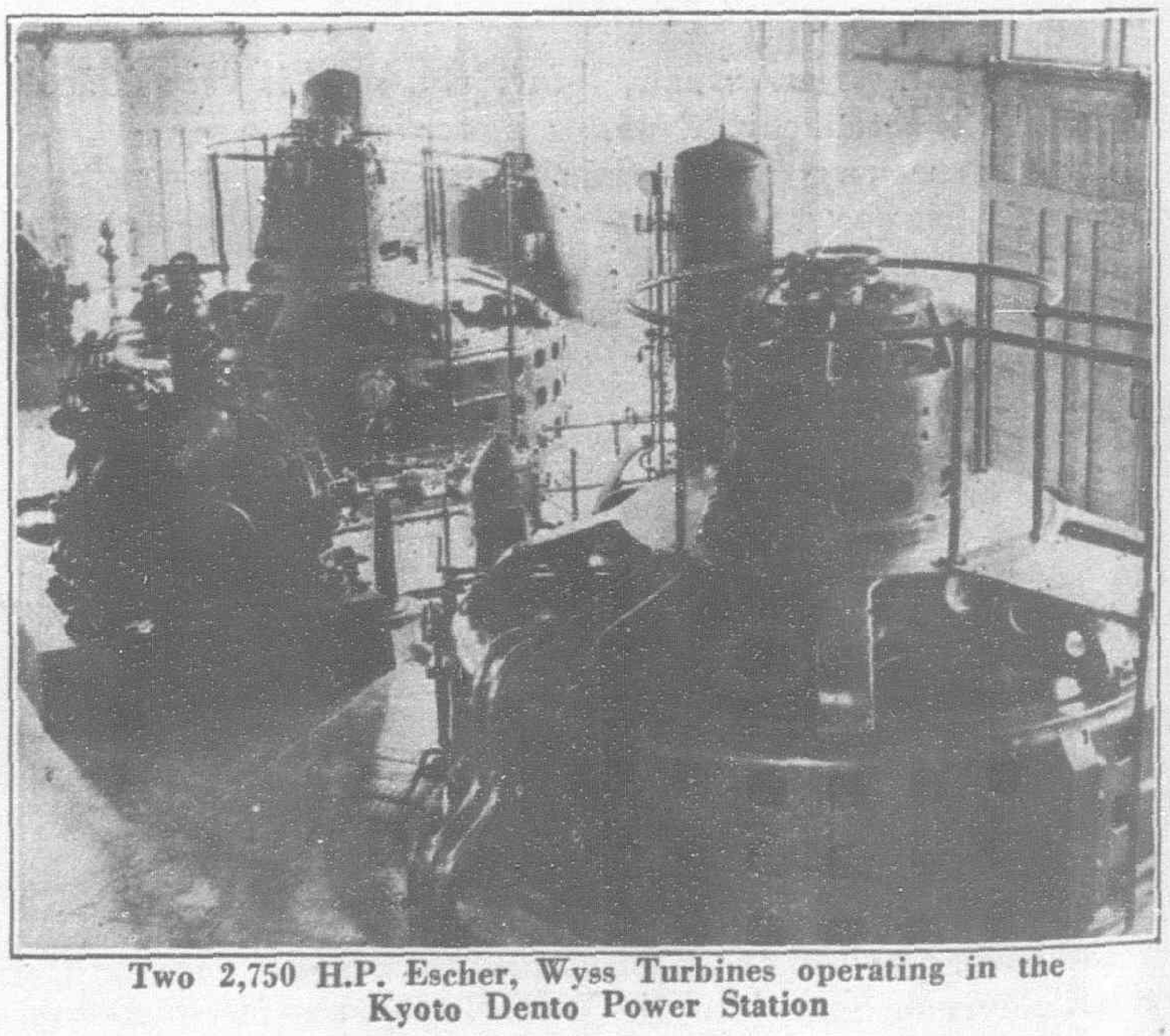
The development of the Teikoku Dento has steadily followed along the line of amalgamation with small lighting companies, especially in the second half of 1917, and even after the panic of 1920 no adverse effects are seen in the company's reports, as indicated in the following table:—

Half Year	Paid-up Capital Yen	Net Profits Yen	Dividends Yen	Rate of Dividend Per cent.
1915, 1st	880,000	45,111	35,200	8
2nd	1,000,000	53,589	42,000	8½
1916, 1st	1,000,000	64,656	50,000	10
2nd	1,000,000	77,402	55,000	10
1917, 1st	1,000,000	84,967	60,000	12
2nd	1,704,000	137,749	102,270	12
1918, 1st	1,775,000	151,410	106,500	12
2nd	2,830,000	314,922	169,800	12
1919, 1st	2,830,000	350,308	169,800	12
2nd	2,830,000	372,351	169,800	12
1920, 1st	5,175,400	567,880	310,525	12
2nd	6,489,200	724,951	389,525	12

Unfortunately, when the old company was dissolved early in 1921, no report was issued, and it has been impossible to include the first term of business in 1921 in this table. On March 1, 1922, this company called up the outstanding Y.1,840,000 unpaid capital,

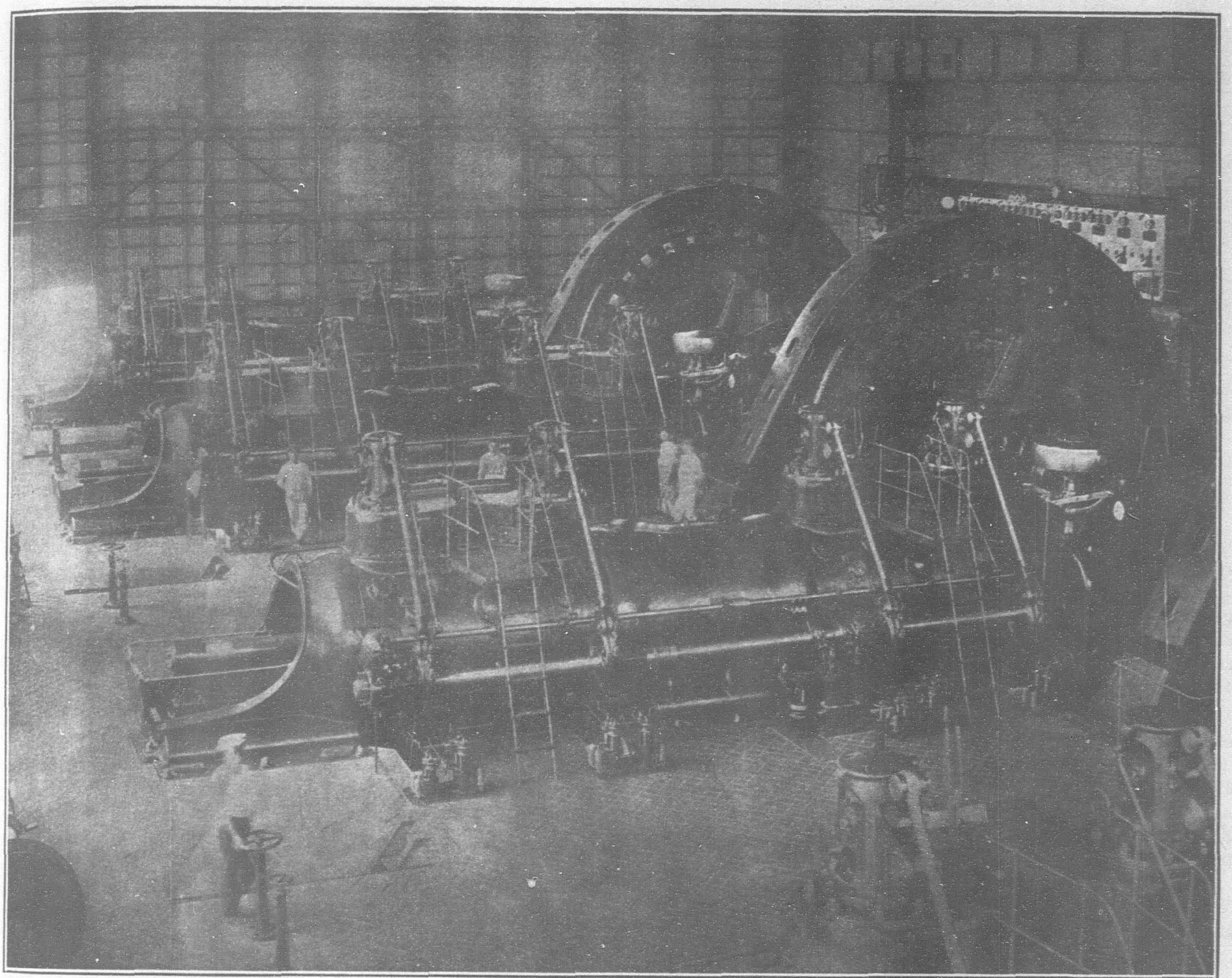


Six 12,500 H.P. Escher, Wyss Turbines installed in the Power House of the Tokyo Dento Company

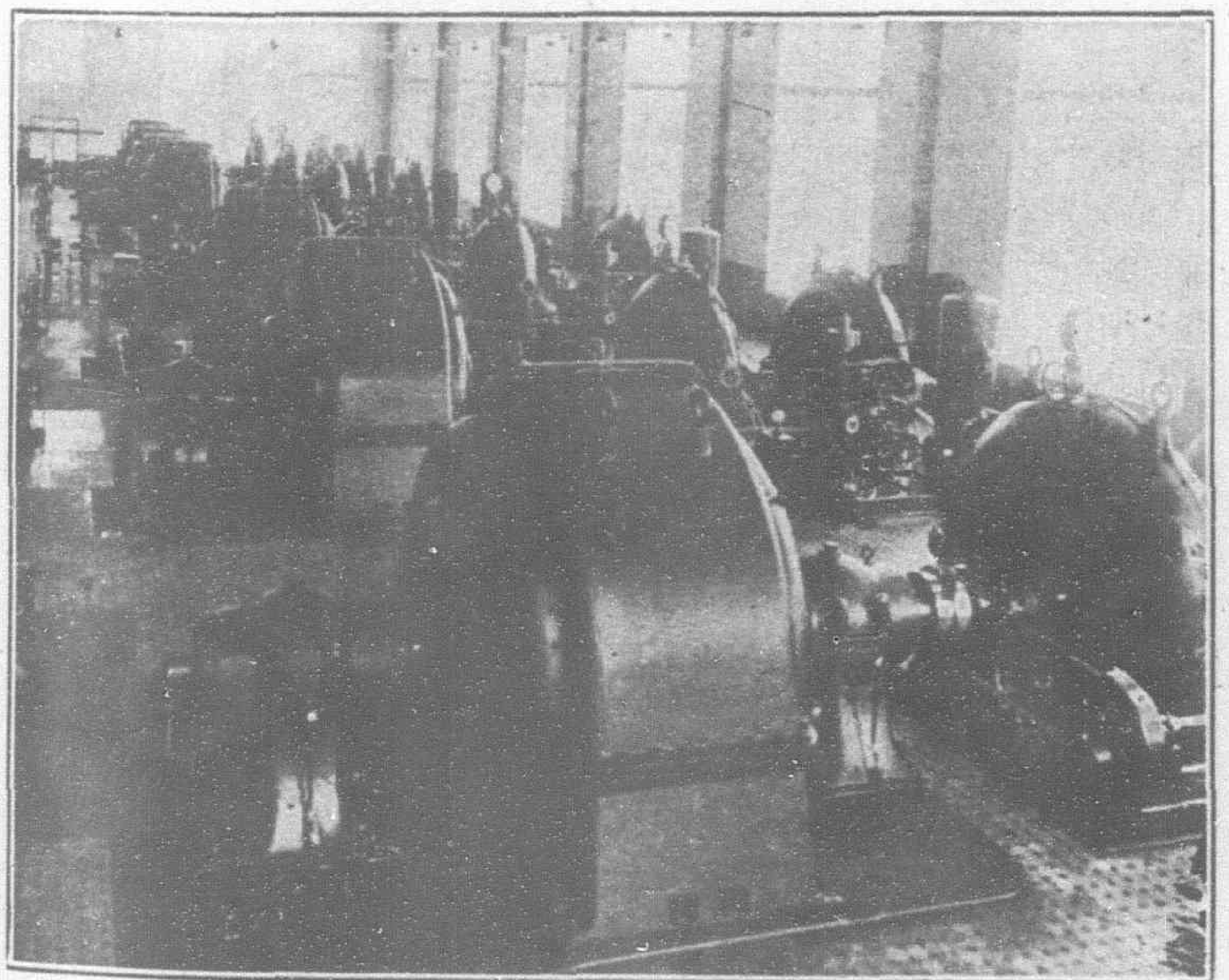


Two 2,750 H.P. Escher, Wyss Turbines operating in the Kyoto Dento Power Station

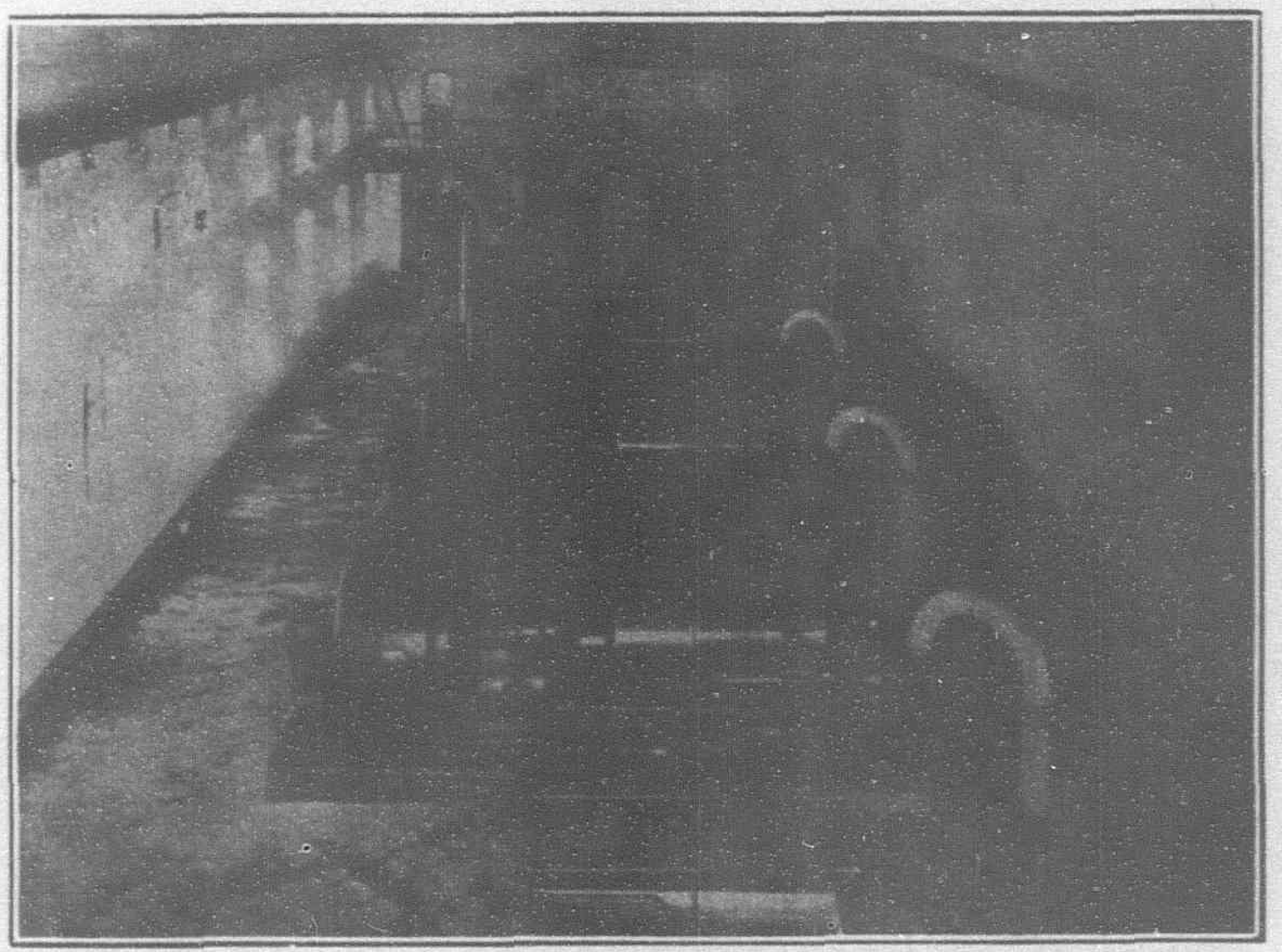
ENGLISH ELECTRIC COMPANY (DICK KERR) INSTALLATION IN JAPAN



Interior of Imperial Government Railway's Power Station near Tokyo, showing one of Four Sets of Two Dick Kerr Alternators, 1,500 K.V.A. each, 3 phase, 25 cycles, 11,000 volts, 94 rpm, driven by Lilleshall Gas Engines

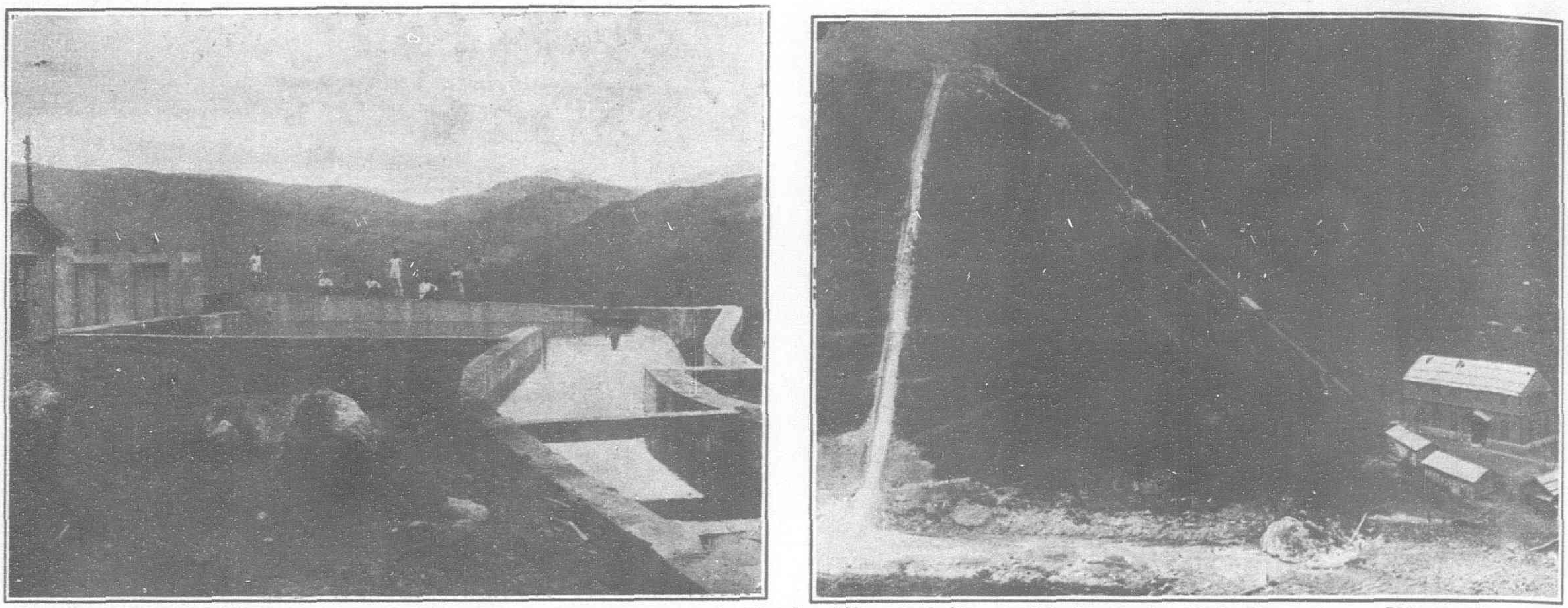


Interior of the Inawasniro Hydro-Electric No. 1 Power House at Fukushima-ken, showing 6 Dick Kerr Alternators of 7,775 K.V.A. each, 3 phase, 30 cycles, 6,600 volts, 375 rmp, driven by Escher, Wyss Turbines



Interior of the Keihan Electric Railway Power Station at Osaka, showing 3 Dick Kerr Alternators, each 850 K.V.A., 3 phase, 25 cycles, 2,300 volts, 1,500 rmp.

A MODEL WESTINGHOUSE INSTALLATION IN JAPAN



The Intake and Power House of the Denki Kagaku Kogyo Kabushiki Kaisha (Electrical Chemical Industry Co., Ltd.) located near Niigata, Japan

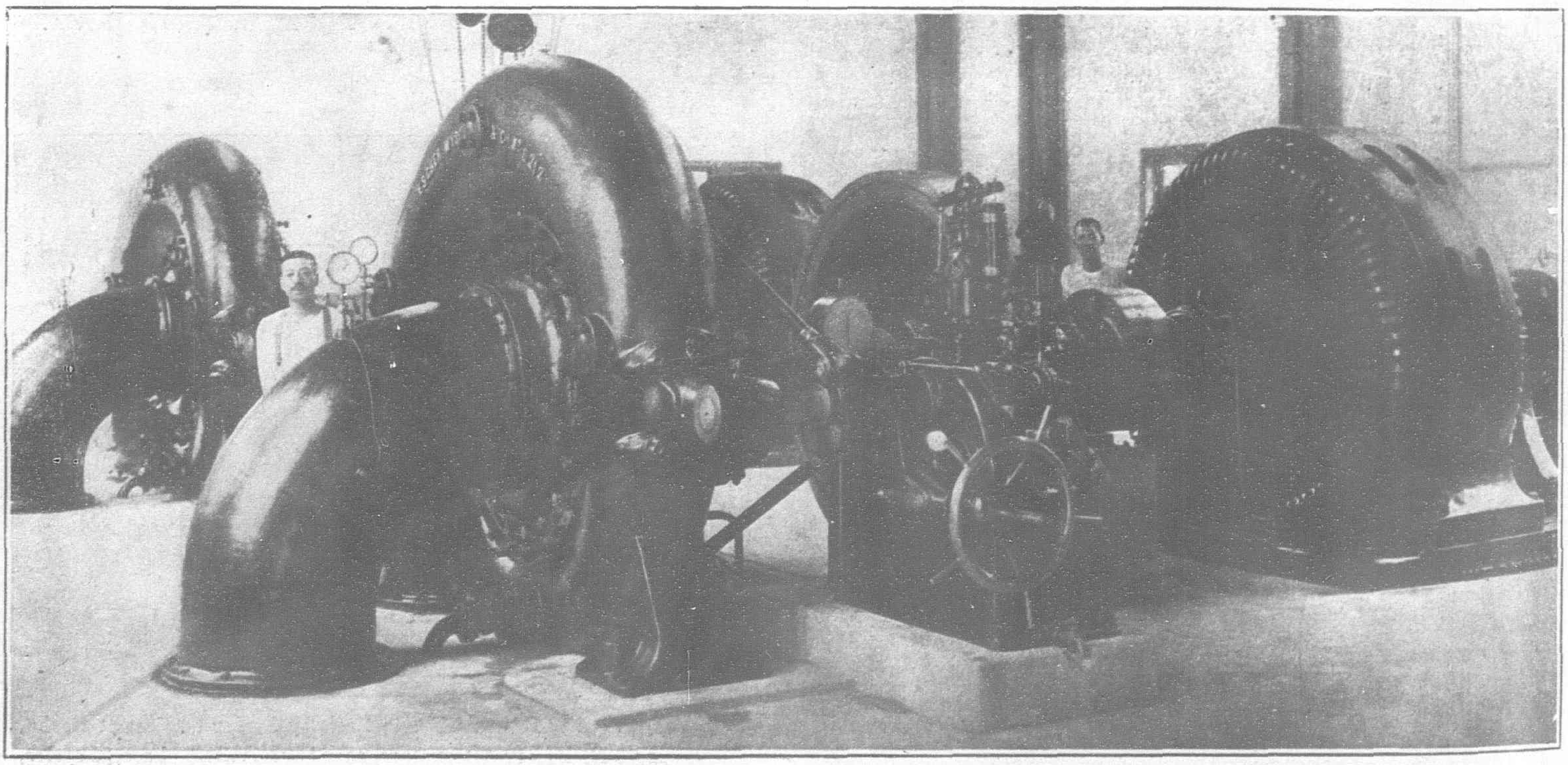
which brings the total up to its authorized amount of Y.24,645,000, fully paid-up.

Recently the department of communications licensed the amalgamation of the Teikoku Dento with the Saitama Dento K.K. and the Santan Denki K.K., and in order to purchase these concerns the company's capital was increased to Y.33,252,000. These two amalgamations extend its influence further afield.

From 1921, the business of this company enjoyed a remarkable expansion. During the year the number of lights supplied increased 250,000, and it is now planned to increase the service to supply 1,000,000 lights in all. In order to carry out this plan it is necessary to build a new power plant on the Kinugawa which will develop 2,100 kilowatts, and another 2,000 kilowatts, steam generating plant will be built at Miatsu in Tango province.

Plans are also afoot to effect an amalgamation with the Yuragawa Suiryoku Denki K.K., generating 2,000 kilowatts. If this is carried out the capital of the Teikoku Dento must be increased to Y.50,000,000. This increase was authorized at the last general meeting of the shareholders of the company, and it was decided to issue Y.16,000,000 of new shares at the end of May, 1922, to be allotted to old shareholders on the basis of one new one to two old shares. The issue will in all probability not be floated easily as it is now difficult to sell stocks unless 12 per cent. dividends are visible.

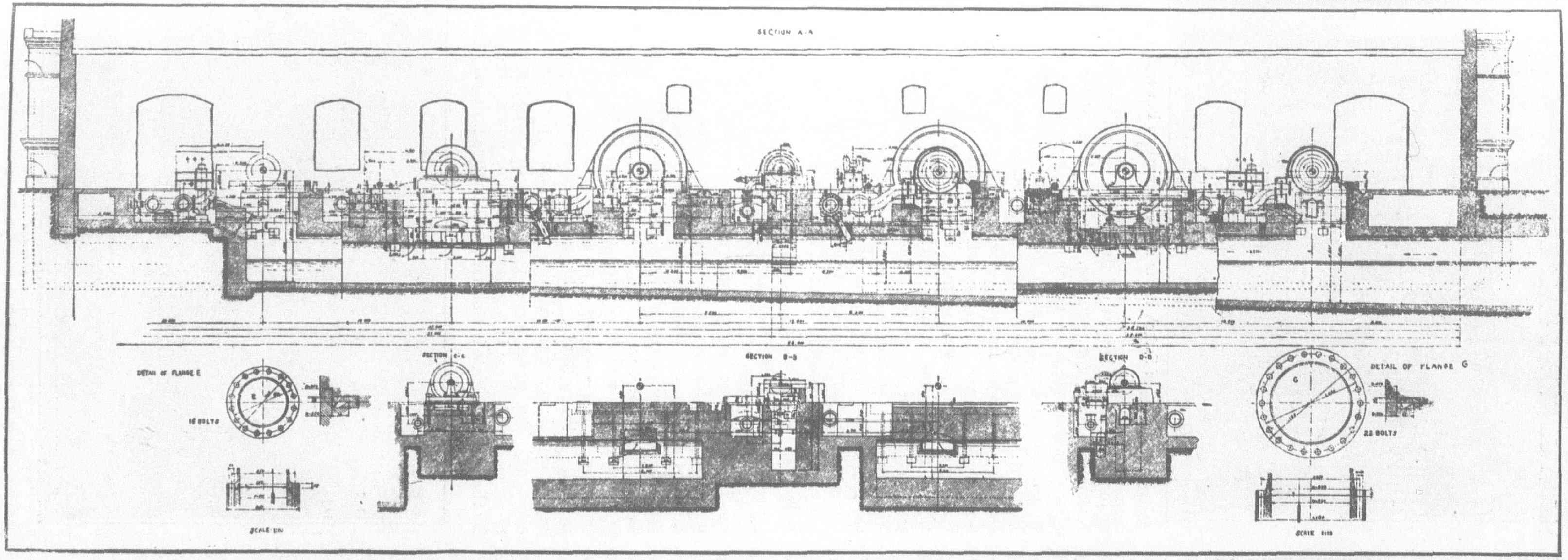
It is also part of the plan of the Teikoku Dento, to annex the Musashi Suiden, capitalized at Y.6,400,000, of which Y.4,600,000 is paid up. It has a water power station at Kawagoe in Saitama prefecture generating 4,000 kilowatts, and an 800-kilowatt steam generating plant. Another station is now being constructed to produce 2,000 kilowatts. The Musashi Suiden supplies 120,000 lights and sells power amounting to about 3,000 h.p. The generating stations are only about eight miles from Omiya, north of Tokyo, and between the two towns the company operates an electric railway, which the Teikoku Dento will not take over.



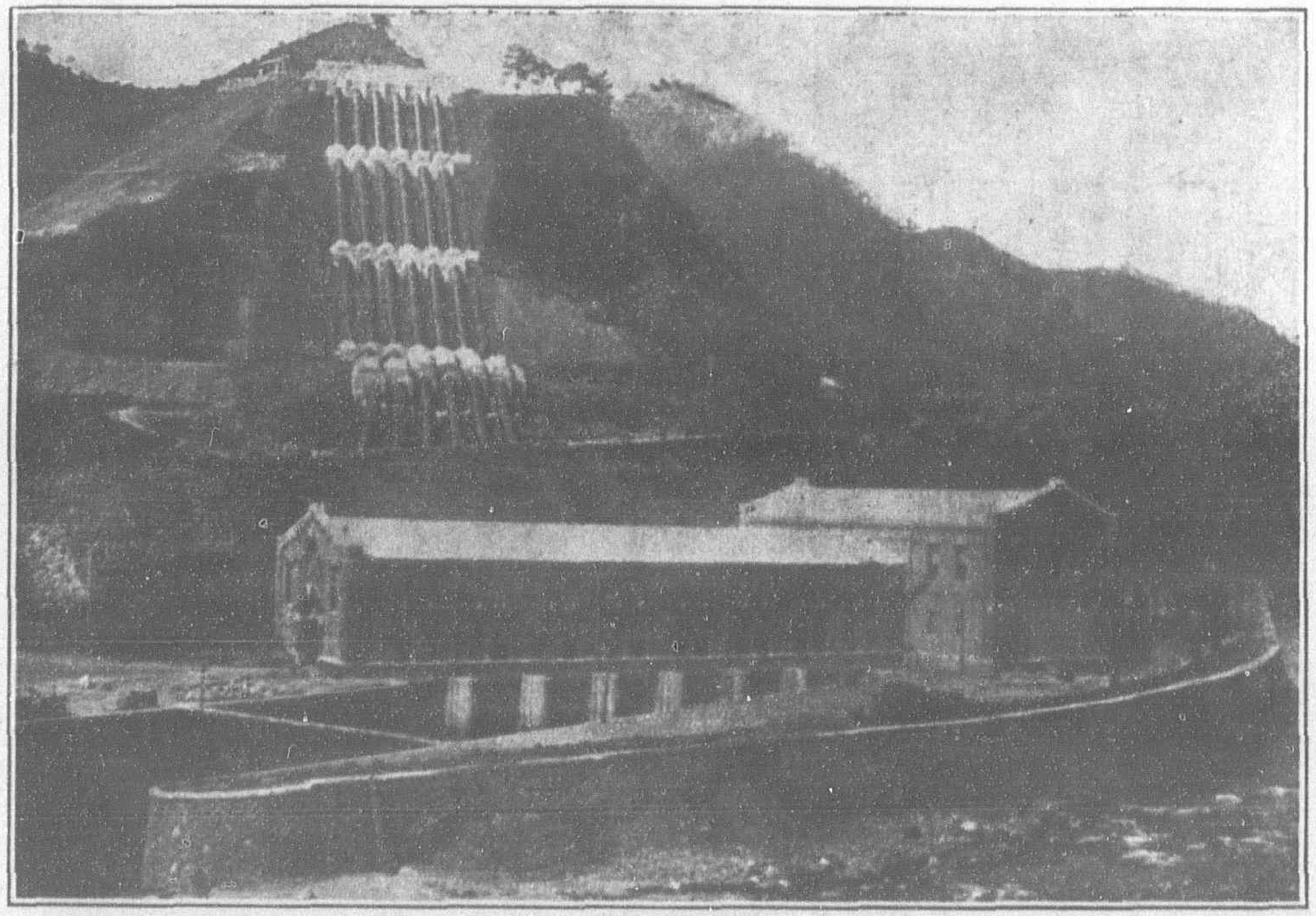
Interior View of the Power House of the Electric Chemical Company at Niigata, showing two 2,500 K.V.A., 50 cycles, 3,300 volt Westinghouse Generators, driven by Escher, Wyss Turbines

PLAN OF THE KATSURAGAWA HYDRO-ELECTRIC POWER STATION

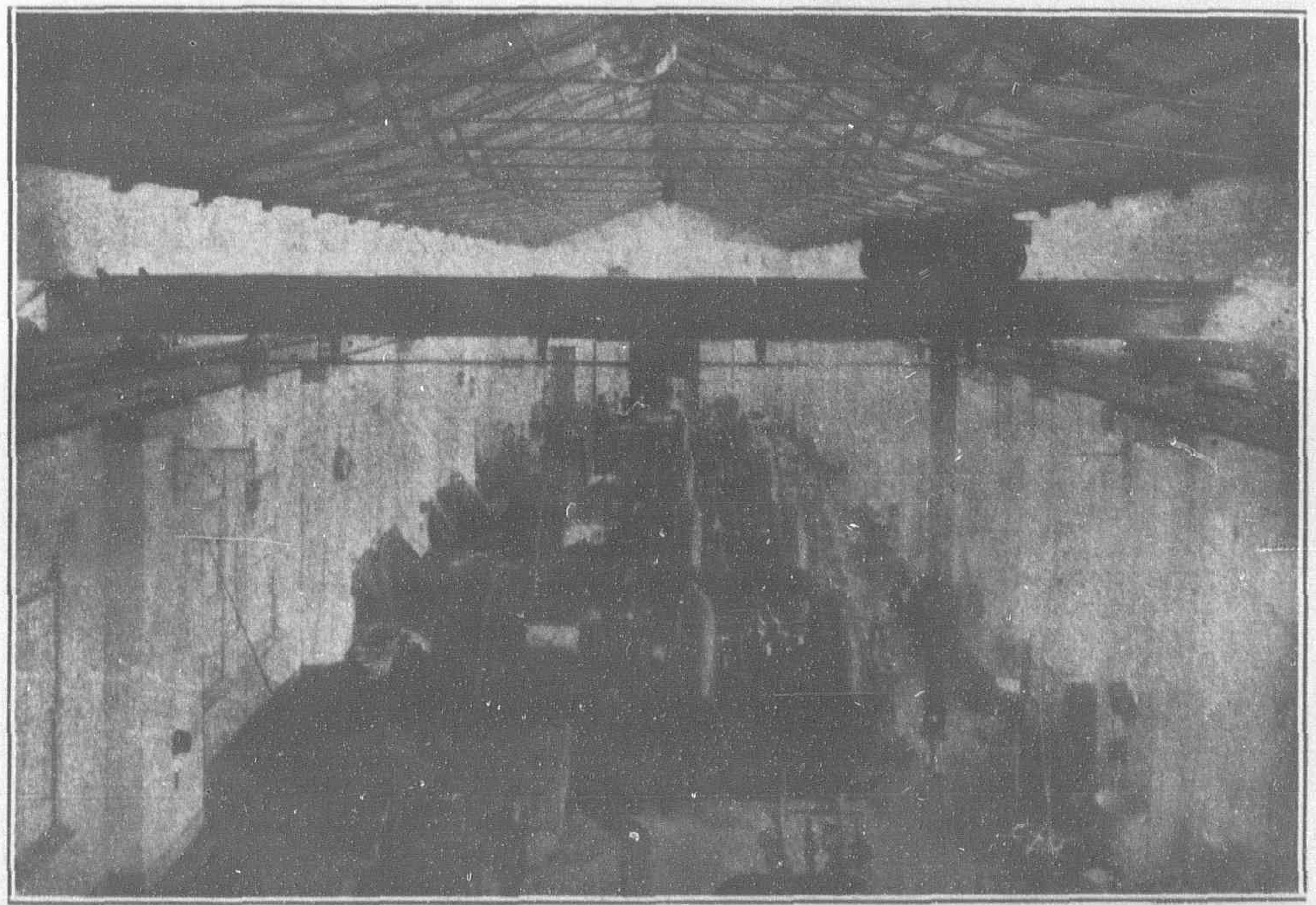
Escher, Wyss Turbines and A.E.G. Generators



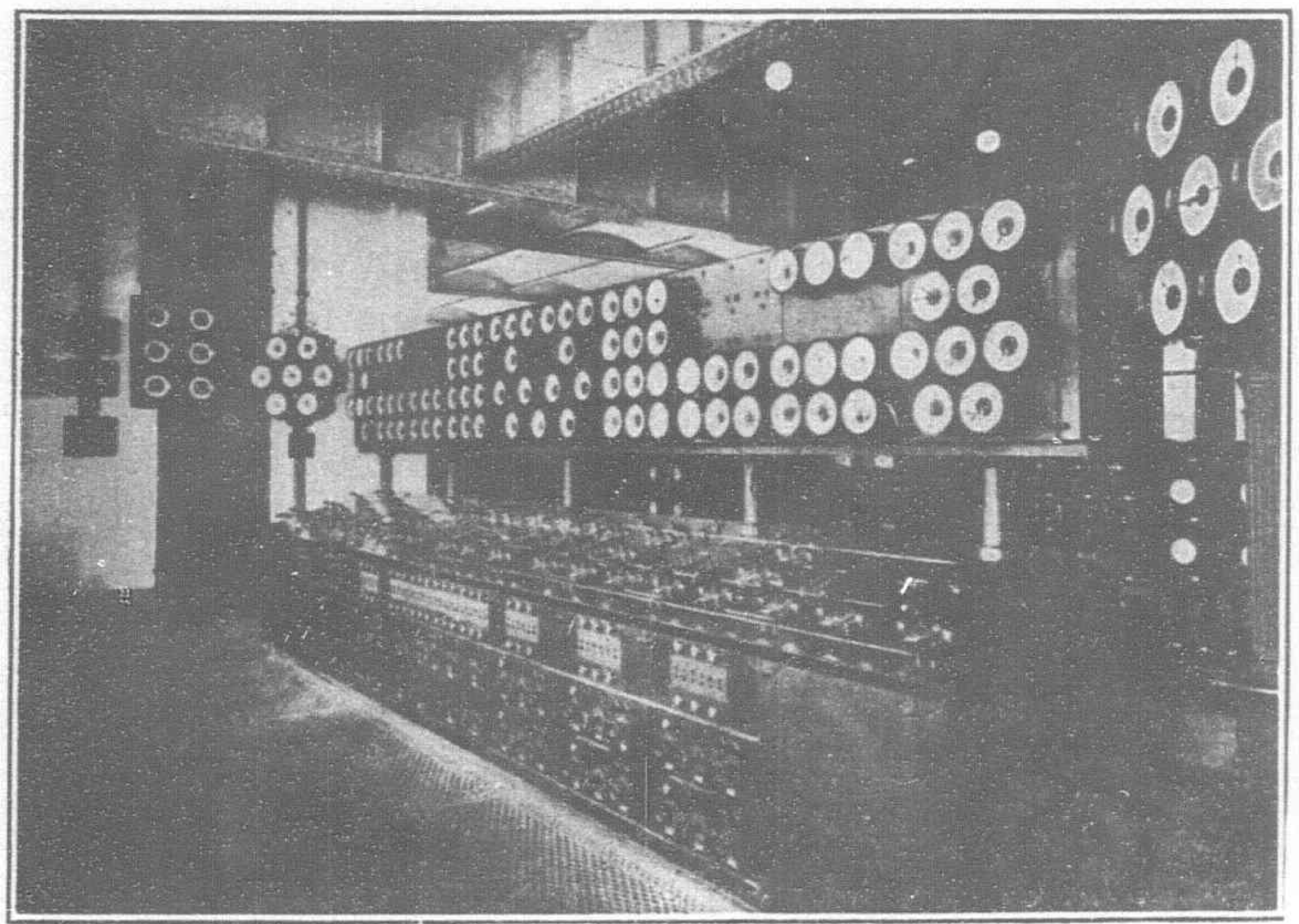
THE KOMA POWER STATION OF THE TOKYO ELECTRIC COMPANY



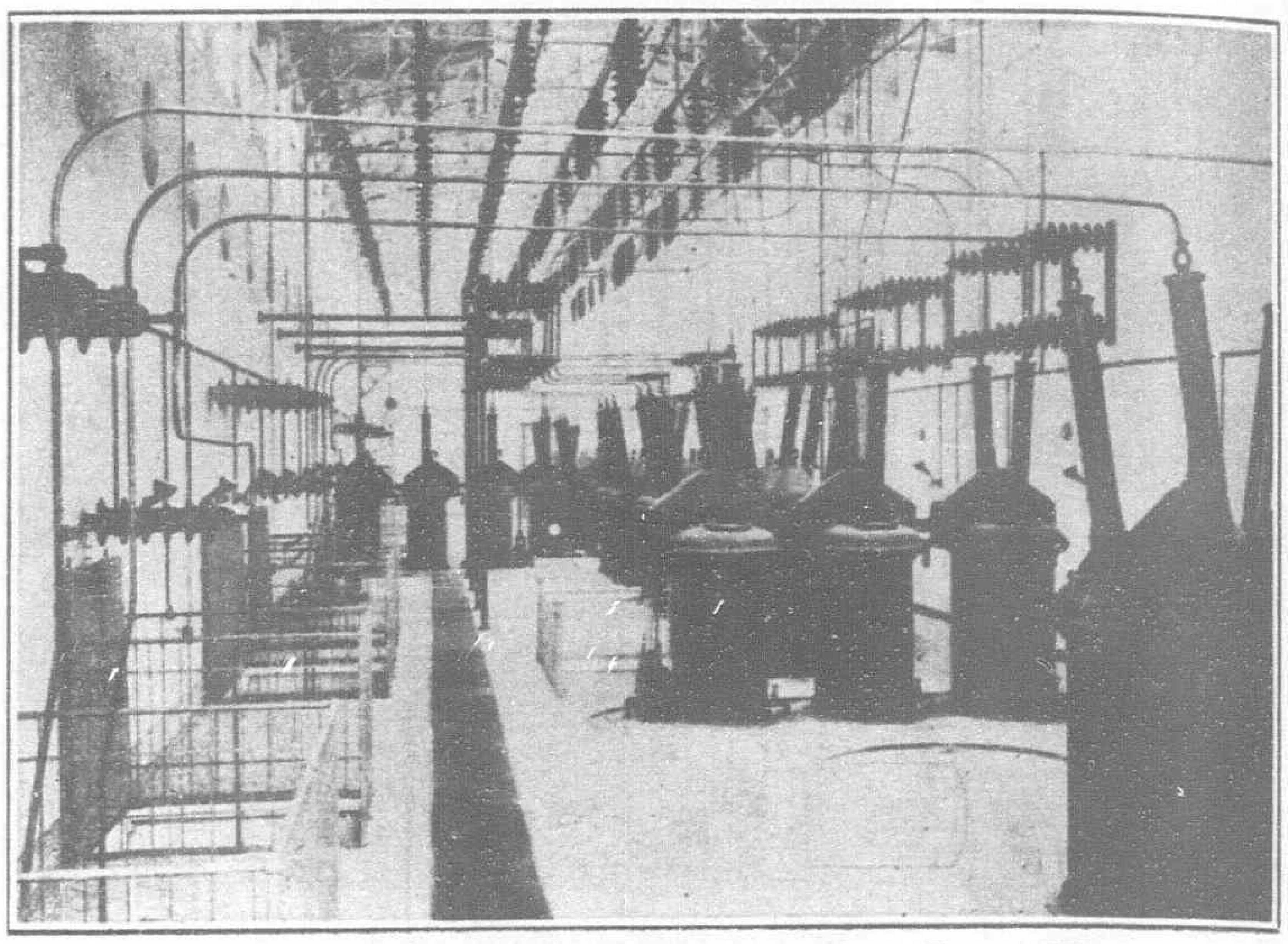
The Power House



Interior View: Siemens Schuchardt Generators and Escher, Wyss Turbines



Main Control Board at the Inawashiro Power House



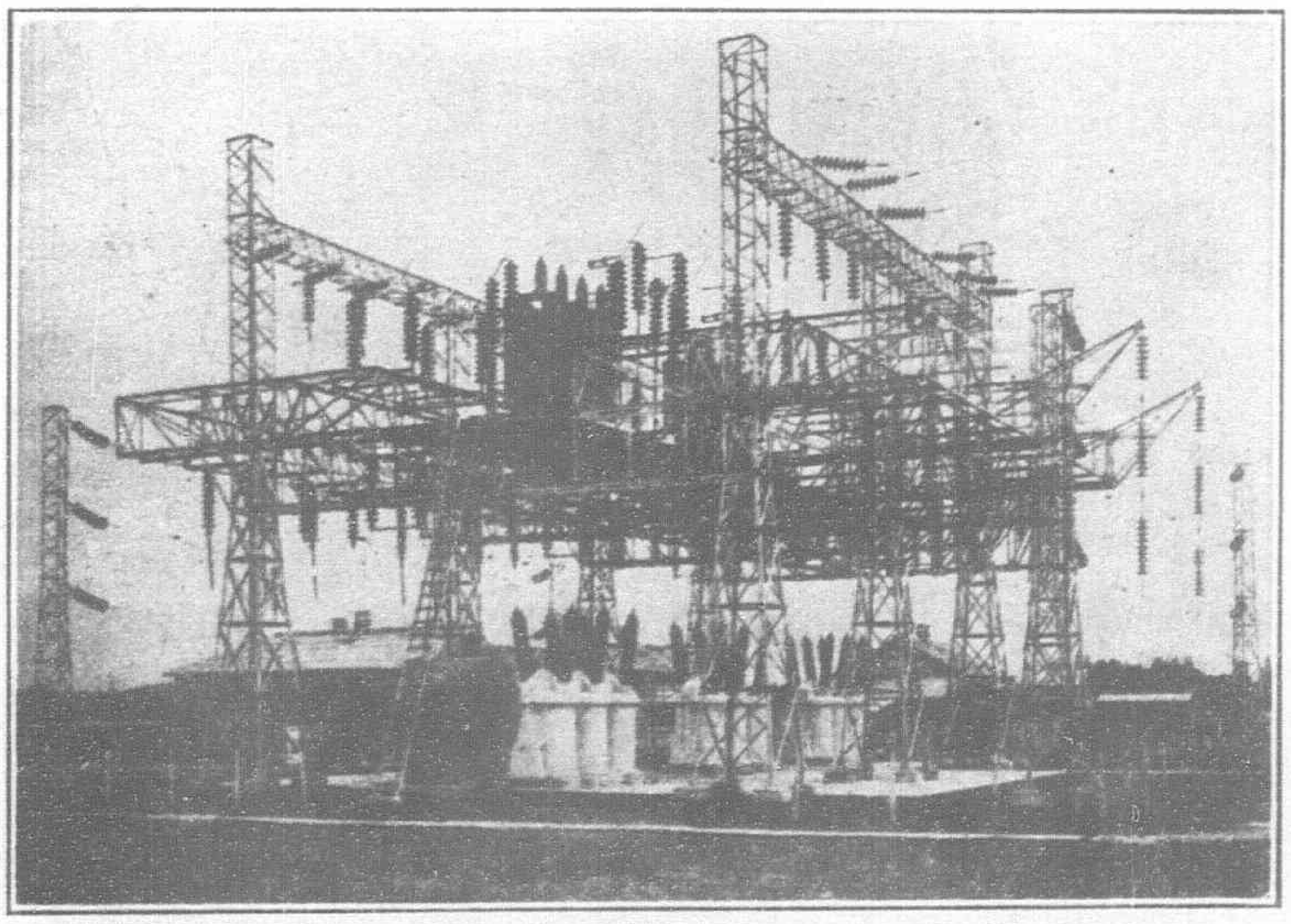
High-tension Switch Room at the Inawashiro Power House

Profits of the Teikoku Dento at the end of March, 1922, are estimated at Y.1,550,000, and a dividend of 10 per cent., 1 per cent. more than at the end of September, 1921, will probably be paid.

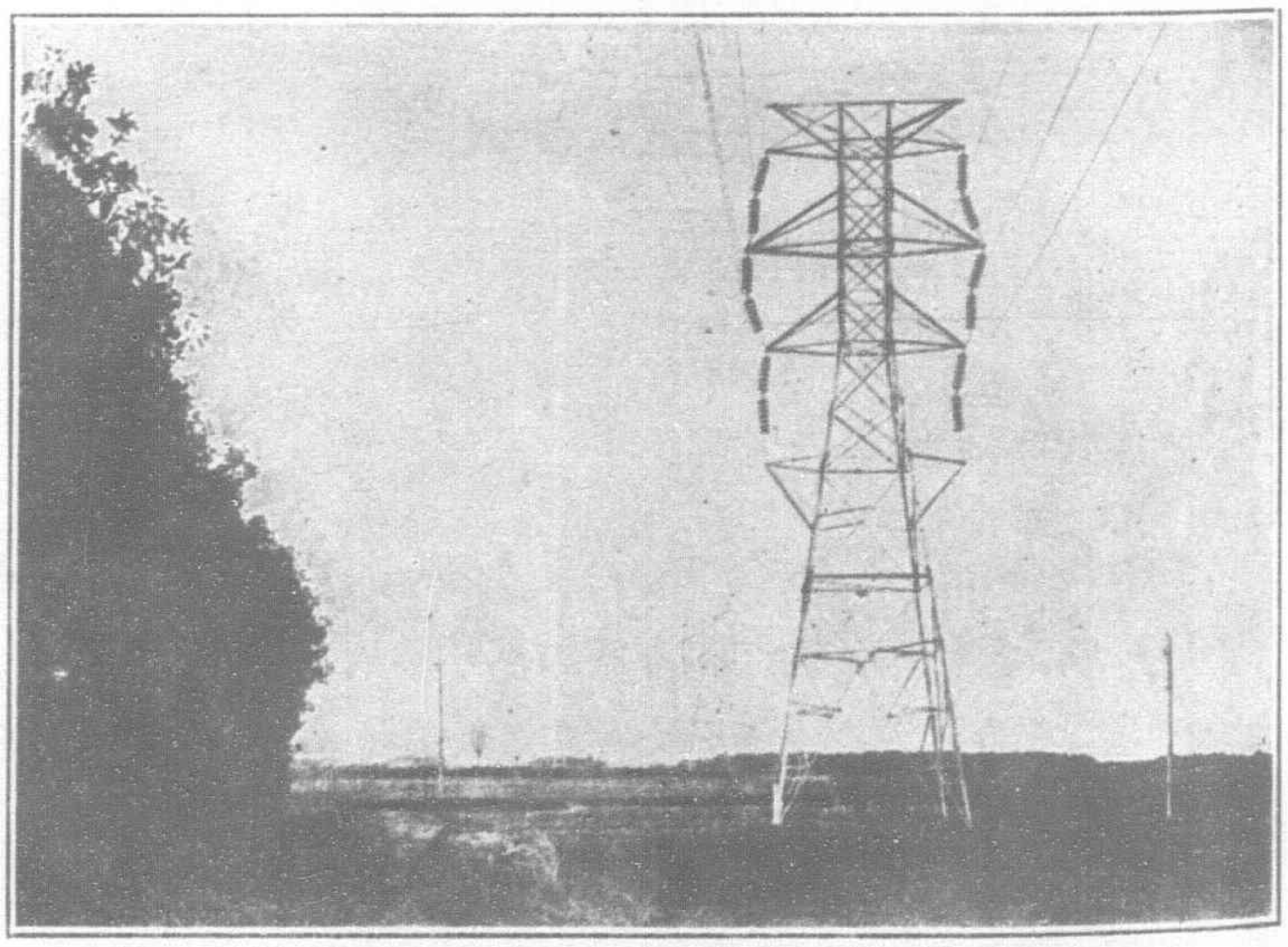
In 1917, control of lighting companies in Chiba practically passed into the hands of the Teikoku Dento. Early in 1918, a new field of operations was entered when the Otaru Denki K.K. and the Hokkaido Denki K.K. were bought out, and operated under the name of the Hokkaido Branch of the Teikoku Dento. By the beginning of 1920, this company had under its direct control 22 electric light companies. It also owned the Teikoku Seiyu K.K. (Imperial Oil Mfg. Co., Ltd.) The greatest advance in the history of the company, however, was made in 1921 when the old company with all its subsidiaries was dissolved on March 31, and reorganized on April 1, 1921, as the new Teikoku Dento K.K. The reorganized company included the Sotobo Dento K.K., the Toyokuni Dento K.K., and on April 16, the Shimotsuke Denryoku K.K. was annexed. This series of important amalgamations at once placed the Teikoku Dento in the front rank of Japanese electric light companies. The company's success has been conspicuous in some districts while in others its failure has been pronounced. However, the fact that expansion has been regular is shown in the foregoing table. Comparing business for the second half of 1921 with that of the first half of 1914, the number of lights increased 20.6 times.

Originally, most of the company's power was purchased from other power supply concerns. What little power it produced itself was generated by gas engines. However, since the annexation of the Shimotsuke Denryoku many changes have been made in contracts for power. Their gas engine generators have been abandoned at most stations. Several of the earlier subsidiary companies, the Katsuura Dento, for instance, generate from water power. The Miura station, south of Yokohama had been using a gas engine to generate power, but since its amalgamation with the Teikoku Dento it bought power from the Yokohama Denki, now the Tokyo Dento. The Seibu station receives power from the Tokyo Dento, and the Sakura and Hishigawa offices from the Tonegawa Hatsuden Sho, now also Tokyo Dento. In the west, the centre north of Kyoto, the Tajima station generates 500, kilowatts from water power, a part of which is supplied to the Fukuchiyama station. The Oyeyama station has its own hydro-electric generator. In the Hokkaido 1,500 kilowatts are purchased from the Oji Paper Company, and 300 kilowatts from the Shiribeshi Denki. The company owns a generating plant of its own at the Iwauchi Suiryoku K.K.

The district north of Kyoto is practically self-supplying. The Hokkaido district gets its principal supply from others. But the Tokyo district lacked water power, especially in Chiba. There is no main line for power transmission in Chiba which can be used between station and station, and for this reason even after amalgamations which have akready been made there, the financial savings from the combinations have been very small. Gas power is uneconomical and small companies are able to supply their own needs by using gas engines at no greater cost than purchasing power from the Teikoku Dento. This was soon found out, and gas engine supply was slowly replaced with water power purchased from other concerns. But water power companies in Chiba have no surplus of current and there is a great scarcity of power urgently needed by the Teikoku Dento in that field. It became necessary therefore to



Utsunomiya Intermediate Switching Station on the Transmission Lines of the Inawashiro Hydro-Electric Company



Type "A" Transmission Towers, Inawashiro Hydro-Electric Company's Lines develop its own water power. To do this would have cost at least Y.1,000 per kilowatt generated, making the cost of light and power too high for practical uses.

Accordingly, the company set out to effect combinations of interests with water power companies in Chiba, and in this way hoped to obtain control of the much needed supply. If this could be effected transmission lines could be built all over Chiba, and all the company's stations connected up by a main line. It was in pursuance of this intention that the Shimotsuke Denryoku was annexed, and there is now enough power available for the company's own use. This combination really opened a new era of expansion for the Teikoku Dento. The Shimotsuke Denryoku Company is a most important acquisition for the Teikoku Dento. Its capital paid up in full before the annexation was Y.3,700,000 and its territory extended from Utsunomiya to Nikko, Imaichi, and Shikamura in Tochigi prefecture: through Noda, Sawara, Tagane, in Ibaraki prefecture, and all over Chiba prefecture, serving more than 70 towns and villages. It owned important hydro-electric generating stations at Nikko, and Ishinada, and was constructing a new power station on the Kinugawa. It also owned important power rights on the Nakagawa. Its high-pressure transmission lines extended beyond its own boundaries, because it bought power from outsiders which it distributed in its own district.

The Teikoku Dento in its Tokyo field, at least, was distinctly not a self-sufficing concern, so far as power was concerned, depending largely on the Tokyo Dento for current. But the Tokyo Dento recently entered upon a period of extremely active expansion of its boundaries, and by purchase, co-operation and investment has so greatly increased its power rights during the past two years that the Teikoku Dento began to fear for its continued independent existence, foreseeing that unless something very radical were not done to secure its position it would probably be driven out of the Tokyo field by lack of water power. Naturally, the annexation of the Shimotsuke Denryoku was a most opportune piece of business for the Teikoku Dento.

In 1912, the Shimotsuke Denryoku supplied 15,923 lights, and 594½ h.p. In 1921, before the combination was effected, it supplied 119,480 lights and 3,091½ h.p. It supplies 43,917 houses in Tochigi, Chiba and Ibaraki prefectures with light. The Teikoku Dento not only got much needed water power from this amalgamation but expanded its boundaries for light and power supply.

Before the annexation, the Teikoku Dento and the Shimotsuke Denryoku were paying dividends of 12 per cent. a year. The amalgamation was expected to permit a higher rate of dividend to be paid, but the terms of the amalgamation, placing the shares issued to the old shareholders of the Shimotsuke on a 10 per cent. basis, and the expenses of continuing the expansion deemed necessary to the company's continued existence as an independent concern, decreased the profit rate last year, and the common shareholders received only 9 per cent. in September, 1921.

The first business term of the new company will be completed on March 31, 1922. The number of lights operated was announced to be 590,729, ten c.p. in December. Power sold amounted to 7,902 h.p. This is a satisfactory situation, and business is known to be gradually expanding.

The head office of the Teikoku Dento K.K. is in Tokyo, with eight branch offices in Chiba prefecture, four in Ibaraki prefecture, two in Saitama prefecture, one in Tokyo prefecture and one in Kanagawa prefecture. There are 17 offices in the Tokyo district.

Westinghouse Radio Broadcasting Service

On account of the great success and wide-spread interest that has been the outcome of pioneering in radio telephone broadcasting by the Westinghouse Electric & Manufacturing Company, the company has announced a complete plan of covering the entire United States with a service to the home that will allow anyone, anywhere in the country to enjoy the many benefits of radio. The operation of the first radio broadcasting station of its kind in the country at East Pittsburgh, Pennsylvania, for the past twelve months, has opened possibilities hitherto undreamed. From this station alone persons in Canada, New England, Florida, Arizona, the Dakotas, and at greater distances, have been able to enjoy the service. Even in Cuba, Mexico and on ships in the middle Atlantic and on the Gulf of Mexico many have heard the concerts broadcasted from East Pittsburgh.

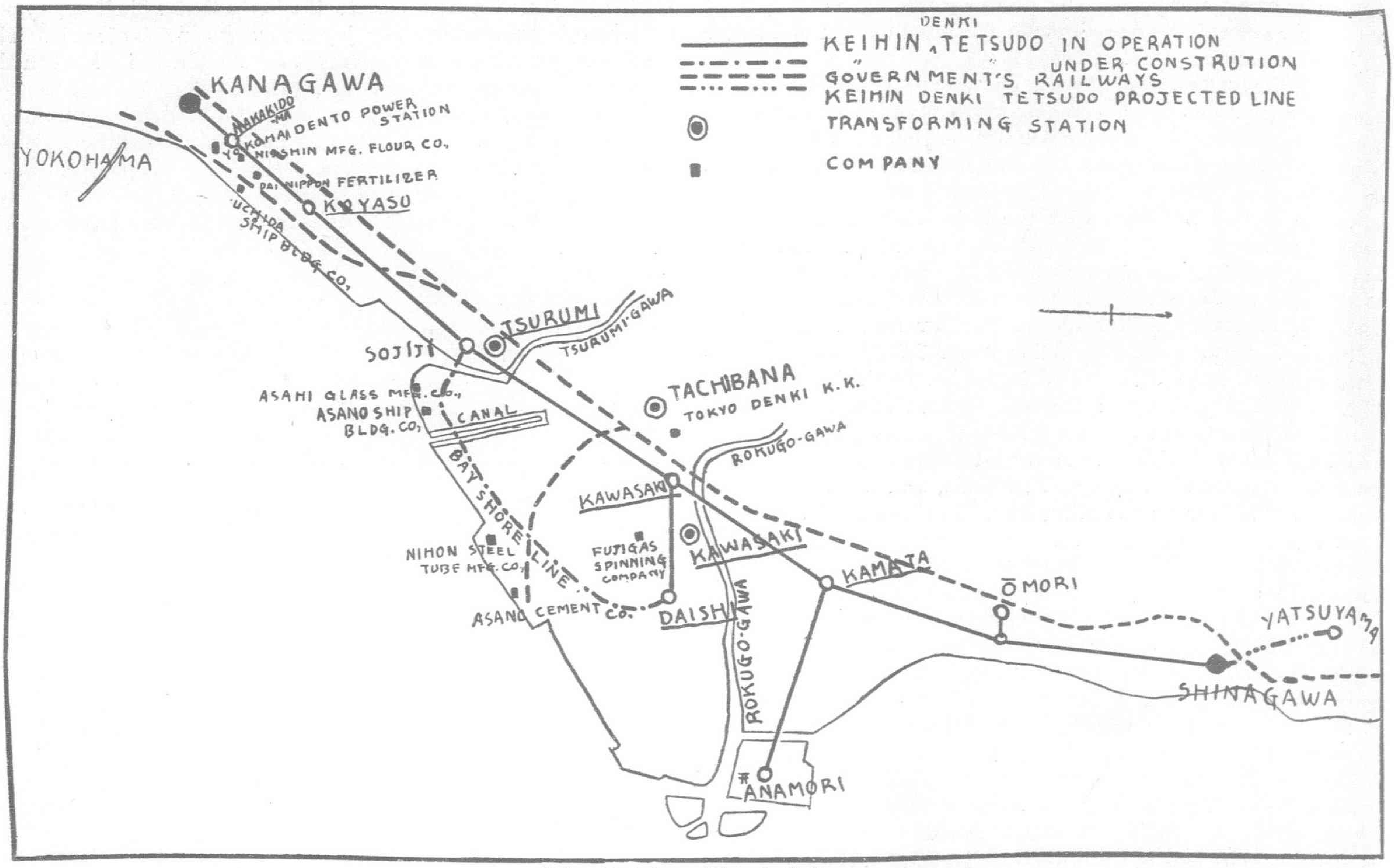
In order to cover certain parts of the country not reached by this station, and to intensively service other parts, the Westinghouse Company has laid out a complete program, and has already added three large stations. At Springfield, Mass., station WBZ supplies New England; at Newark, N. J., station WJZ takes care of the Middle Atlantic and Southern States; and at Chicago, Ill., station KYW services the Middle and Western States.

The fact that the pioneer work of Westinghouse has not been in vain is shown by the fact that although operating a full year, station KDKA at East Pittsburgh continues to interest more people as time progresses. This is due, however, not so much to the novelty of radio telephone broadcasting, but to the well-planned and diversified program that has been established. The service started with the transmission of presidential election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theatres, musical recitals, reports of boxing contests, results of baseball, football and basket ball games, complete minstrel shows, government market reports, New York stock market reviews, national and international news from the station at East Pittsburgh. At Springfield, Mass., in addition to many of these features, there is a periodical talk to farmers about market and stock conditions. A feature of the Newark, N.J., broadcasting station has been bedtime stories for the children, marine information, and talks on radio. The complete transmission of grand opera from the Chicago Opera Company productions has been the feature of the recently established station on the Commonwealth-Edison building in Chicago. It is predicted that as a result of the diversified entertainment and information which have been broadcasted through these stations during the past year this service will prove of expanding value and distinctive interest to mankind. In all probability radio will be as popular in the home as the phonograph is to-day, and will be of as great interest to the public as the moving picture show.

The programs as conducted by Westinghouse usually last for an hour each evening, and they are announced far enough in advance to enable everyone interested to know what is contemplated. Such stars as Geraldine Farrar, Rachmaninoff, Telmanyi, Clarence Whitehill, Mary Garden, Muratore, Edith Mason and Rasia have performed for the radio, and the programs are put on a very high plane. Many speakers of note have talked over the radio, some of them being Secretary of Commerce Herbert Hoover, Assistant Secretary of the Navy Theodore Roosevelt, Secretary of War Weeks and Secretary of Labor Davis.

In order to perfect the transmission of music by radio Westinghouse engineers have made considerable research studies of the different frequencies of music. A studio has been built especially for the singing of artists so that the reproduction will be accurate. The studio at East Pittsburgh consists of a room 20-ft. by 30-ft. completely lined with burlap and cloth and without windows so that there will be no reflection of sound. These reports are checked later with the reception qualities at a receiving outfit. A considerable amount of data already obtained indicates the proper methods of transmitting various types of music.

This work is simply a sample of the many things being done to perfect the service and make radio broadcasting a real benefit to the public.



Tokyo-Yokohama Electric Railway

Japanese Electric Railways Expanding

The Tokyo-Yokohama Electric Railway

THE district between the port of Yokohama, Japan's outlet for trade with the Americas, and Tokyo, its capital and largest city, ten years ago was frequently described as "one long village." To-day, a more apt description would be, a "long industrial town." The change in Japanese life brought about by the progress made during the war period 1914-1920 (Spring), has been such that what was formerly pre-eminently an agricultural region supplying farm products to two cities whose populations were about two and a quarter millions, is to-day a building ground for important factories whose needs are only partly served from the population of three millions which have crowded old Yokohama and Tokyo out into the country in a search for more space in which to live. Ten years ago, both Tokyo and Yokohama were beginning to spread beyond their ancient boundaries. The petty Japanese style houses never built with more than two stories, and a Japanese prejudice against living in building with other families (only the lowest classes do that), prevents the growth of large populations in a limited area. It became increasingly difficult to find land within the circumference of the cities to house the growing population.

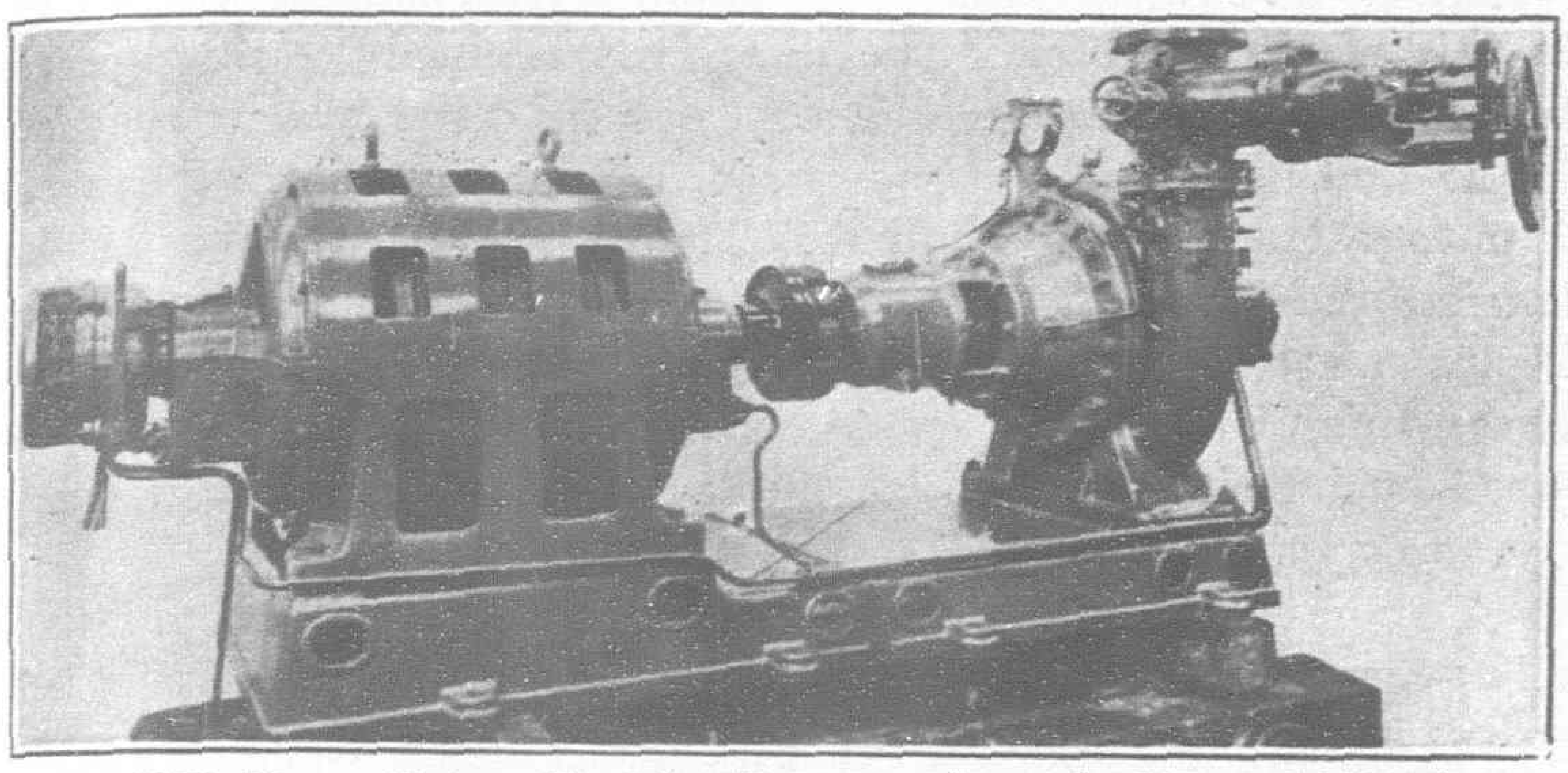
The line of least resistance was along the Tokyo Bay shore between Tokyo and Yokohama, because along that line there were:

(1) A government railway with several stations at important centres of population between the two cities; (2) an interurban electric railway; (3) a national road none too broad, which furnished the main artery for vehicles, and an even greater hand car traffic between the two cities.

Homes were slowly pushed out into the country and when the great boom in manufacturing industries came, it was only natural that promoters should turn for building sites to localities where the population was greatest. The land between Tokyo and Yokohama also offered convenient transportation to an open port of regular call, as an attraction to factory builders. As factories sprang up between Tokyo and Yokohama, the population of the towns and villages grew by leaps and bounds, and land prices soared. This drove farmers to sell their ancestral holdings, and eventually practically all the land between Tokyo and Yokohama along the main lines of traffic was owned by factories, house builders, or by land companies.

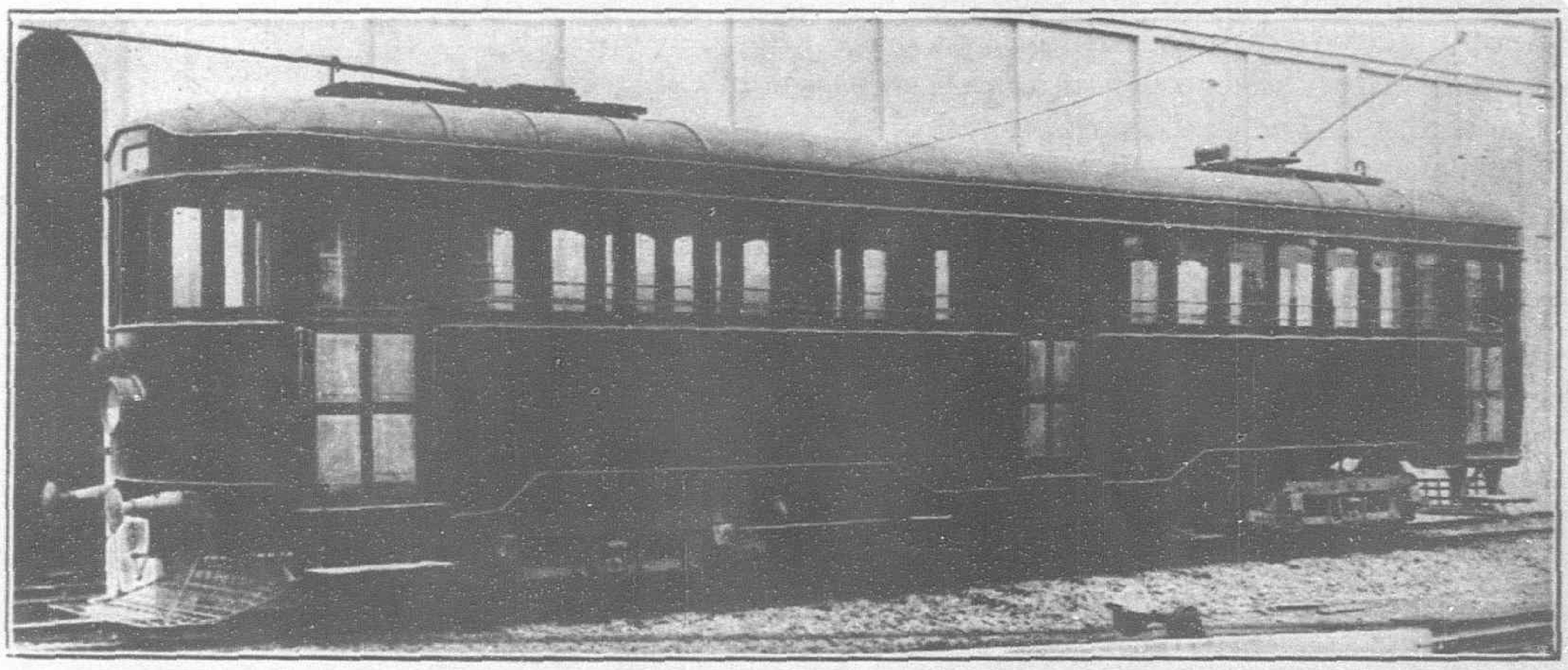
Much of the growth of this district was primarily helped by transportation facilities, and one of the most important of these facilities, is furnished by the lines of the Keihin Denki Tetsudo (Yokohama-Tokyo Electric Railway). The Keihin Electric Railway was first established in 1897 to operate a short excursion line from Kawasaki station, to Rokugo Bridge, near the popular shrine called Kawasaki Daishi, a distance of 1½ miles. The company was capitalized at Y.98,000 and was called the Daishi Denki Tetsudo. Its usefulness was unquestioned and its success immediate. It was not until January 1903, that the present Kawasaki-Kanagawa (Yokohama) section was opened for commercial business, to be extended to Shinagawa (Tokyo), by the end of December 1905. Between Yokohama and Tokyo, commercial transportation is even greater than Osaka and Kobe, despite the common illusion held abroad that Kobe and Osaka are the commercial centres of the Japanese empire, a view usually held by traveling salesmen who knew nothing of Japanese business methods and consequently found it easier to get orders in less careful Osaka and Kobe than in more exacting Tokyo and Yokohama.

In 1907, the Keihin Electric Railway carried 1,500,000 passengers between Yokohama and Tokyo, but in 1915, when the Imperial Government Railways opened their electric line between the same cities, with stations at all the important population centres, and terminals in the hearts of the two cities, the effect on the Keihin line's passenger traffic was immediately disastrous, passengers carried between the two termini, Kanagawa and Shinagawa, both in the suburbs, decreasing to 370,000, and the company's annual dividend rate immediately thereafter fell to the unheard-of low figure 4.8 per cent. Its shares, previously quoted above par (50 yen) fell at once to Y.25.00, a drastic cut. Unfortunately for the Keihin Railway neither its Tokyo nor its Yokohama terminus is in the heart of the city. This has been the great reason for the decline in the number of passengers carried through between Tokyo and Yokohama. However, the loss in through passengers has, to some extent, been made up by the great increase in local passengers carried. And this increase has been particularly marked since the industrial development of the Keihin district began after 1917.



500 H.P. Motor Driven Turbine Pump made at the Nagasaki Works of the Mitsubishi Zosen Kaisha

Any transport line operating between Tokyo and Yokohama occupies a position of great importance and has most profitable potentialities. Such towns as Tsurumi, Kawasaki, Kamata and Omori, are only getting started in their industrial stride. As the number of factories increase, during coming years, the number of persons having need of the local services of the Keihin Electric Railway will increase accordingly.



New Type of Passenger Car on the Yokohama-Tokyo Service of the Keihin Electric Railway

Recently the Keihin adopted a plan to open a new line along the bay shore in a most advantageous position. Even if the official line does run through the same general districts the Keihin line nevertheless performs a most important service in assisting the development of new residence and industrial districts south of Tokyo. South of Tokyo, factories have sprung up everywhere, in Oimachi at Rokugogawa near Kawasaki, and in Tsurumi, the Asano shipbuilding works are also in Tsurumi, while on the reclaimed lands at Koyasu near Yokohama an entirely new residence districts, for Yokohama is now developing. The future of the Keihin Railway is therefore brilliantly hopeful.

The Keihin Electric Railway Co. undertakes the supply of lights and electric power in certain of the towns and villages along its line; in Omori, Iriarai, Oimachi, Kawasaki, Haneda, Tsurumi and 13 villages. The growth of industry in Rokugo and Tsurumi recently has greatly stimulated outside demand for power and light. But between Omori and Kamata the Company meets competition with the Tokyo Dento Kabushiki Kaisha and in Tsurumi it encounters competition from the Yokohama Dento, recently absorbed by the Tokyo Dento. Kawasaki, however, lying between these two belts of competition is a monopoly territory of the Keihin, and the future for its supply of lights and power in that town is extremely hopeful, as Kawasaki is the centre of the new industrial belt south of Tokyo. In the first half year of 1921 the Keihin operated 84,420 lights, of which 14,101 were in Kawasaki, 17,609 in Iriarai, and 10,394 in Omori.

Since September, 1921, an arrangement has been made between the Keihin Dentetsu K. K. and the Gunma Suiryoky Denki Kabushiki Kaisha whereby the two companies act together especially for the supply of power in the district operated in by the Keihin Dentetsu. The Gunma company's power station is not yet completed, but will be ready to supply the Keihin with 6,000 kilowatts by June, 1922. This will make the Keihin self-sufficing for power, and free it from one of its greatest anxieties, competition with the Tokyo Dento on either side of its supply boundaries. Eventually, the Gunma Suiryoku will be amalgamated with the Keihin Dentetsu, the directors of the Keihin say.

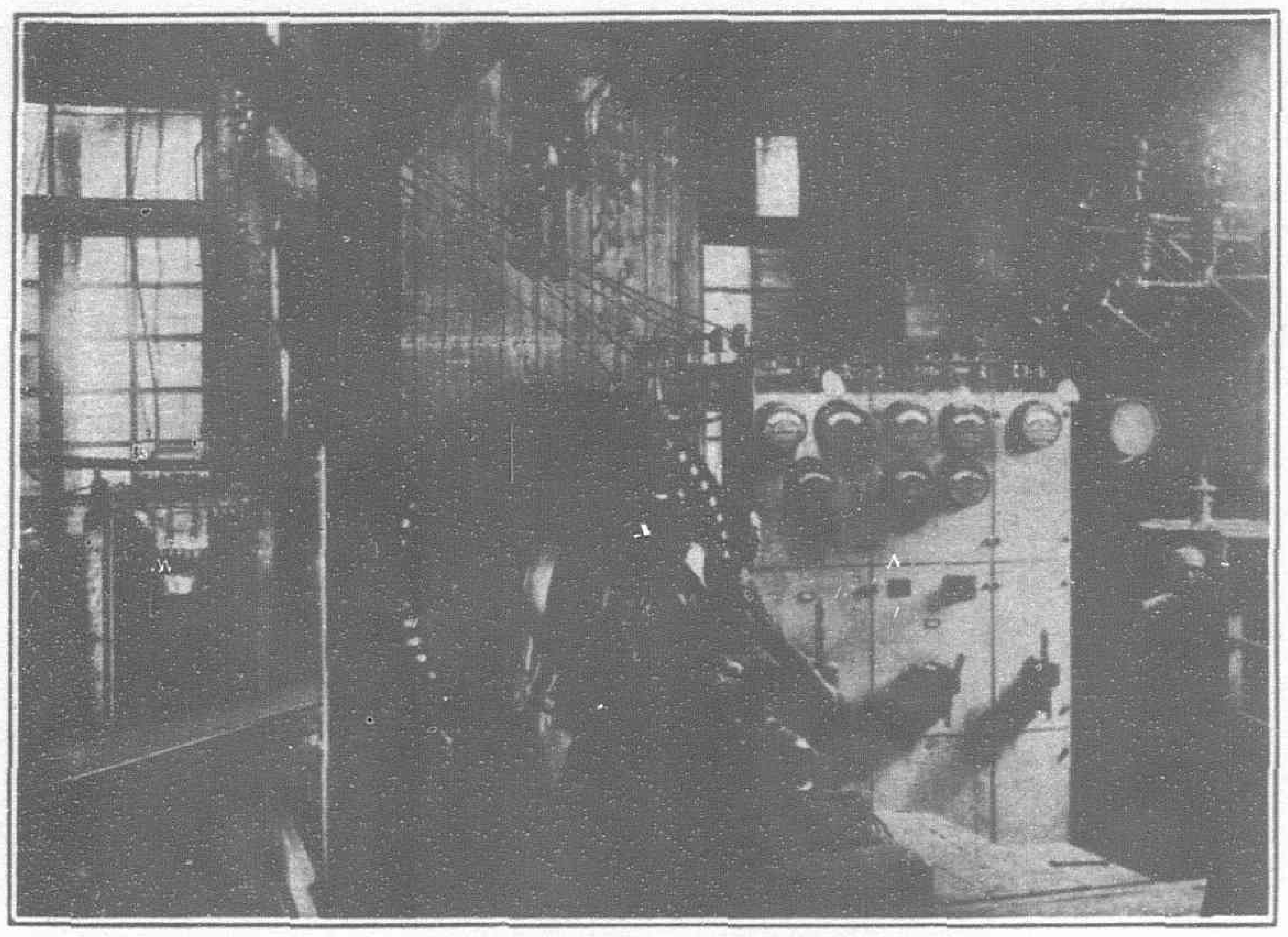
The following table shows the growth of this company's light business :

1919	64,775	lights supplied
1920 June	71,596	,,
1920 December	77,804	,,
1921 June	84,420	,,
1921 December	91,994	,,

At the same time, despite the slump in manufacturing industries, the quantity of power sold is steadily increasing.

One of the most important questions now confronting the Keihin Denki Kabushiki Kaisha is the problem of a terminus in the heart of Tokyo city. The present terminus, Shinagawa, is extremely difficult to get at, and this inconvenience affects the decrease in the number of through passengers carried between the two great cities. In pursuance of a fixed determination to get into Tokyo from Shinagawa, an arrangement was made for co-operation with the Tokyo municipality whereby the company obtained the right to enter the city by an underground line to be started in two or three years from now. Still another plan is to bring the terminus across the bridge which now separates it from the city and the terminus of the municipal surface lines, and to run the company's cars into, or along side, the Imperial Government Railways' Shinagawa railway station. But against this plan is the fact that there are already eight lines of track now using this station, and there is no space available for widening present accommodation. But the plan has been approved, and the Keihin must bear two-thirds of the expense of necessary construction.

A bridge will be built from the present Shinagawa station of the Keihin across to the Shinagawa railway station, but in order to do this the street between must be widened to accommodate the city surface line tracks, and the Keihin Railway tracks, four tracks in all. To do this the street must be widened 90 feet, for



Teikoka Electric Light Co. Interior of Coal Power Station, Fukuchiyama, Tantan District

it is planned to lay the tracks farther apart than they are now laid.

Negotiations are under way for the purchase of the land required for the right of way. This will take some Y.300,000, about one-third of the value of the property. When this arrangement is completed the city tram lines will use the same terminus platforms as the Keihin Railway Co.

A new line already mentioned is to run between Tsurumi station on the government railways to Daishi station on the Keihin line. The line will be built and operated under the name of another company but the Keihin Electric Company owns all the shares. This is a common expedient, because new electric railway companies are not required to pay taxes for two years after the opening of business. After these two years have been passed it will be annexed to the Keihin. The authorized capital of the company is Y.2,000,000, which will probably all be paid up before the amalgamation takes place. It will run through a district very well suited for factory sites, and it is the intention of this company to build a canal to Kawasaki cutting through the district covered by the Kaigan Kido, and with this end in view it has been buying up land on both sides of its projected canal route, and the railway line as well. This land is owned by a " Home Building Company " a subsidiary of the Electric Railway Company.

The national highway running through Kamata will shortly be rebuilt in another place. This will naturally greatly affect the economic growth of this district, as the road will be widened and bettered. The present line of the Keihin Railway is built on the national road for a distance of two miles between Umeyashiki and Minamizoshi. When the road is rebuilt the Keihin will change its present rail equipment to 100-lb. rails, in place of the 61-lb. rails now in use. The change will cost Y.280,000, it is estimated.

A great amount of money will be required to complete the projected canal which is to open the district between Kawasaki and Tsurumi to the sea through a port at Kawasaki on Tokyo Bay. Running south from Kawasaki station, the Asano shipbuilding yards, and the other Asano enterprises at Tsurumi have built accommodation line generally known as the Asano freight line. Along the bay shore south of this line, and to the east of the Keihin line great efforts are now being made to boost the land for use as factory and home sites. The projected canal from Kawasaki will run from Haccho Nawate along the main line of the Keihin Railway through Noda Mura, and along the Ushioda sea shore, past the Asano Steel Works. It will be 8,100 feet long and 120 feet wide. Each bank will be 72 feet wide and especially built up for factory sites. The building work will give the company some 260,000 *tsubo* of land along the canal which can be sold at a profit over and above all costs of original purchase and construction. In June, 1919, it was decided to invest Y.2,300,00 in this scheme.

In June, 1920, Y.1,230,000, in December Y.1,420,000 and in 1921, another Y.1,770,000 was expended, the original appropriation, having proved insufficient. It was estimated that building the banks and the canal would cost about Y.10 a *tsubo* of land obtained from the construction work. If only Y.25 a *tsubo* can be obtained from the land built up and demand is good, a good profit will be made out of the ingenious scheme. The company is now putting the finishing touches to a new line between Omori sea shore passing through Morigasaki to Anamori, and thence to Daishi, Kawasaki. From Daishi to Tsurumi the newly planned Kaigan Kido will connect up this whole territory. The districts traversed by this line are densely populated around Omori, but in other places they are not so well developed. Land is still cheap, and the new line will help to attract home builders. There are no factories in this district, and it is hoped to keep them out, so this territory ought to prove attractive to prospective home builders. Morigasaki is a very fine place. This scheme plans for residence districts between Omori and Daishi, with the factory district south of Daishi extending to Tsurumi.

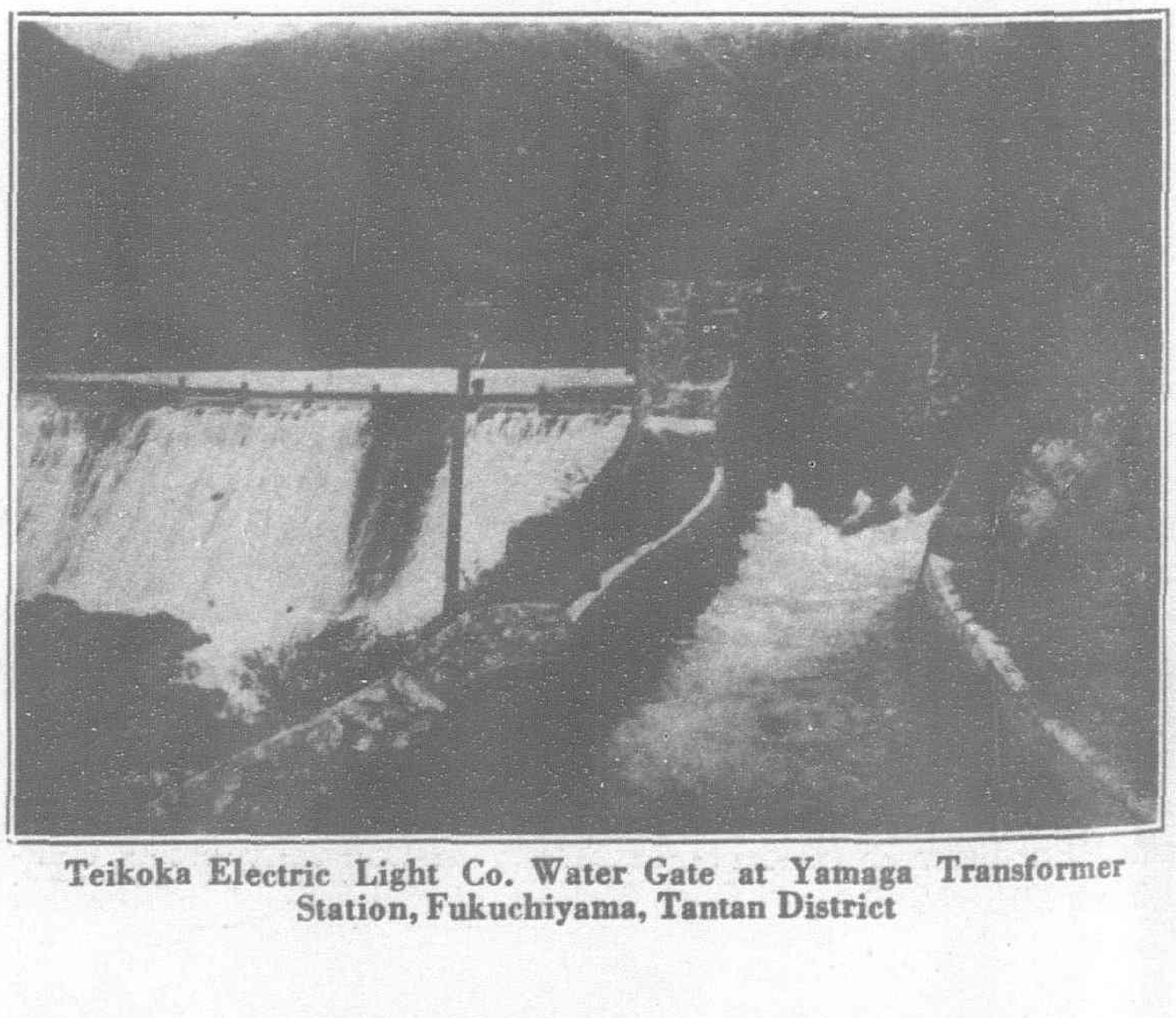
To complete the connection of the line from Anamori to Daishi, it is necessary to bridge the Rokugo River. As the line is now built it is necessary to go to the main line which has a bridge across this river, for through connections. The main line bridge when built cost only Y.260,000, but to build the one needed by the new line will cost, it is estimated, about Y.2,000.000, which is prohibitive. However, Rokugo river is now being banked up and along the embankments factories will be built. If this factory belt is realized then the expense of the bridge can be met from the increased earning the company's line will make by serving it.

The Five Big Electric Railways of the Osaka District

The five big electric railways of the Osaka district (the Kwansai), are the Hanshin Dentetsu K. K., operating between Osaka and Kobe; the Keihan Tetsudo K.K., operating between Osaka and Kyoto; the Nankai Tetsudo, operating between Osaka and Wakayama; the Osaka Denki Kido, operating from Osaka to Nara and the Minomo-Arima Dentetsu K.K., the present Hanshin-Kyuko K.K., operating from Osaka to Kobe, and to Takaradzuka, and to Arima.

Before the war none of these companies, except the Hanshin Dentetsu paid particularly high dividends; their dividends for the second half of 1914 are given in the following table :—

Hanshin Dentetsu.. ..	.. 13 per cent.
Keihan Tetsudo	.. 6 ,,
Hankai Tetsudo	.. 8.5 ,,
Osaka Kido	.. none ,,
Minomo-Arima Dentetsu..	.. 5 per cent.



Teikoka Electric Light Co. Water Gate at Yamaga Transformer Station, Fukuchiyama, Tantan District

The Osaka Kido was organized and opened for business in the autumn of 1914. During its first term of business it paid no dividends but after a year it was able to pay 7.5 per cent. on preferred shares, and 1.2 per cent. on ordinary shares. But during the seven years from 1914 to 1921, covering the period of war prosperity and panic, all these companies were able to improve their positions, and their dividends for the two terms of 1921 show their advances.

	Profit Rate	(per cent.)	*Dividend Rate*	
	First Term	Second Term	First Term	Second Term
Hanshin Dentetsu	25.7	25.4	13	13
Keihan Tetsudo..	15.2	14.	10	10
Nankai Tetsudo..	18.8	21.3	13	13
Osaka Kido ..	13.3	12.4	10	10
Osaka Kyuko ..	17.4	17.9	12	12

(First term from October, 1920-March, 1921.
Second Term from April, 1921-September, 1921.)

The Hanshin Dentetsu shows an enormous profit rate but continues to keep, its dividends down because of the fear of public opinion which is much opposed to the operation of that line through the crowded districts between Osaka and Kobe. It could easily pay 20 per cent. and more, but fear of the consequences deters the directors. The Nankai Tetsudo is in a similar condition, it could easily pay 15 per cent. or more, but is restrained by fear of the company's monopoly of transportation between Osaka and Wakayama being impaired.

The Osaka Kido and the Keihan Dentetsu had heavy construction expenses to meet during 1921, and although their profits on operation were as high as twenty-two and twenty-three per cent., it was impossible to pay dividends like the Nankai and the Hanshin Dentetsu, because of the losses incurred by interest charges on construction works.

The results shown by the Hanshin Kyuko seem to be the worst of all, but this is only because of the new Osaka-Kobe express service line, in which 70 per cent. of the capital of the company is invested. This line has not been long in operation, and construction into the heart of Kobe city is not yet completed. If profits were figured on the basis of the old Minomo-Takaradzuka line, they would have been more than those of any other of the five big companies.

At one time the futures of these companies were looked upon as being rather uncertain, but due to the expansion of industry in the districts served, and to extensions of their services, their futures are now extremely promising. They are, however, all faced with one immediate necessity, that of re-equipping their lines in order to cope with ever-increasing passenger traffic.

It seems natural to suggest that it would be very simple to increase the passenger accommodation by increasing the number of cars to each train. Two or three carriages could be operated like the government electric line around Tokyo. But this change would be accompanied by several difficulties: (1) necessity of improving the present cars; (2) extensions of generating equipment; (3) a complete change of poles carrying the electric wires; (4) rebuilding stations to accommodate longer trains and (5) a general improvement of the railway beds. It is simple enough to effect changes 1 to 4, inclusive, but in improving the railway beds, lies the real problem of increasing passenger accommodation. In order to bring about this change, large amounts of capital are necessary, and there are some parts of certain lines which could not be re-constructed at any cost.

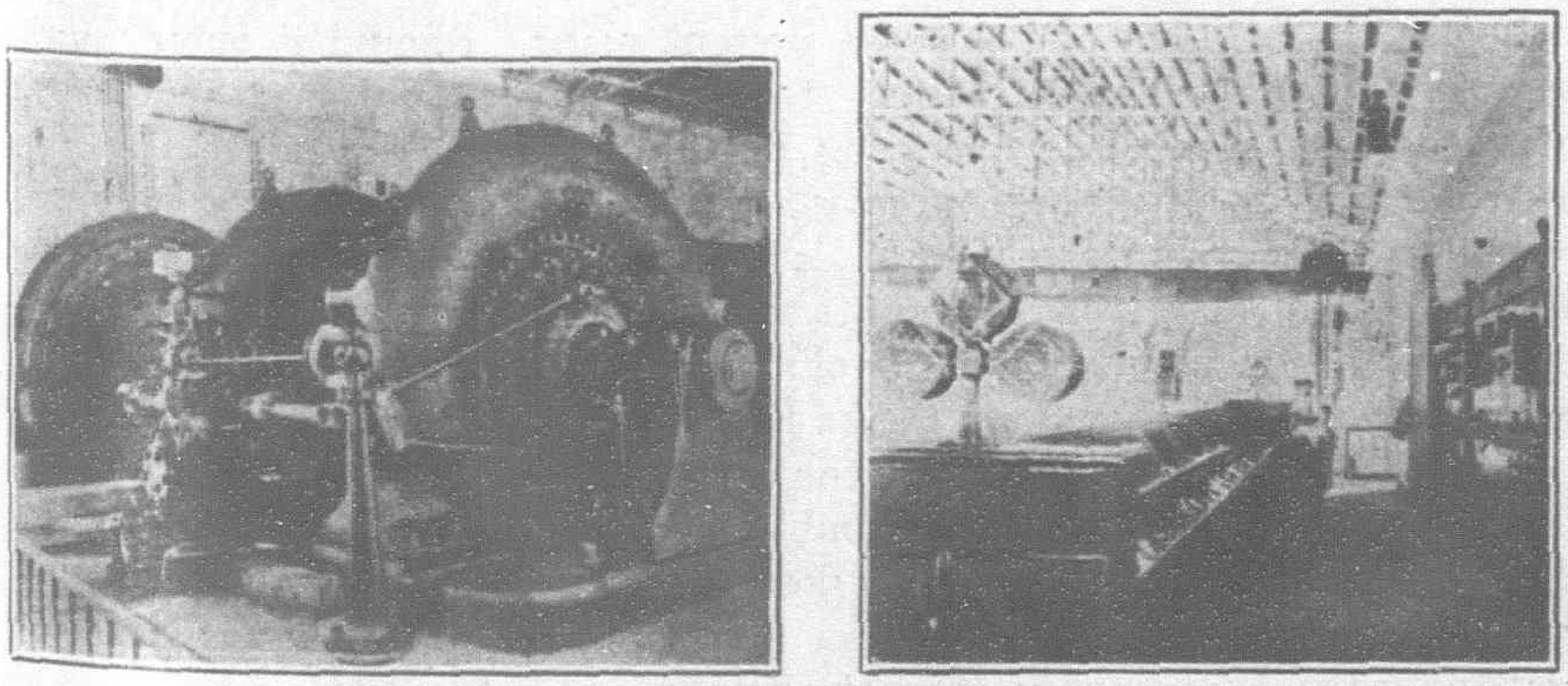
Hanshin Dentetsu

In order to carry out a scheme to operate more than one carriage to a train this company would be obliged to construct a right of way exclusively for railway use. It now uses the principal highways between Kobe and Osaka, running through the most crowded parts of that thickly congested industrial district. It would be essential to re-build the sections between Osaka and Shin-Yodogawa, and between Kobe and Sumiyoshi as elevated railways, so crowded are the streets the present line runs through. By special permission it has been operating two carriage trains since November 1921, but the permission was only granted on condition that the elevated lines mentioned be constructed at the earliest possible date. Consequently, this company can not much longer make such splendid profits. To convert the present railway lines into a right of way exclusively for the use of electric cars, constructing the elevated lines at both ends in Osaka and Kobe, and changing the present 60-pound to 75-pound rails, would cost at least Y.25,000,000. Re-laying the electric wires, improving the cars and reconstructing stations will require another Y.5,000,000. The outside cost would be Y.30,000,000, and the company balks at the expense. A plan has recently been adopted for the construction of a double-track line and the authorities seem to have given their sanction to it. In order to build this new double track at least Y.40,000,000 would be needed. Indecision between the two plans seems to be the reason that nothing has been done so far to relieve a situation fast becoming impossible, especially for the inhabitants of the districts traversed by the company's lines.

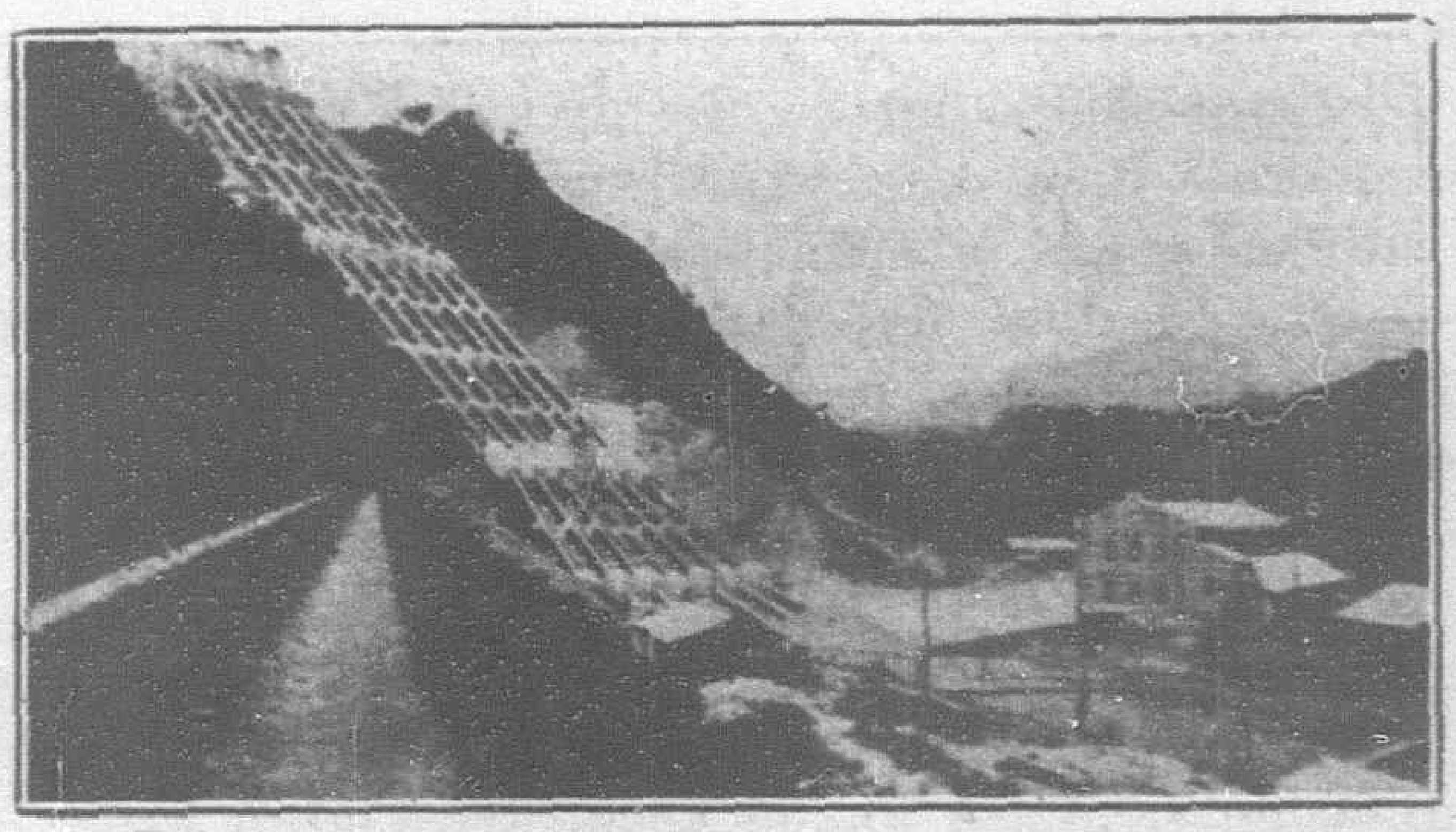
Keihan Dentetsu

The Keihan Dentetsu runs along the Kamogawa (river) from Osaka to the heart of Kyoto, and the entire roadway outside Osaka is for the exclusive use of trams. This line is about the only valuable property of this company. In Osaka, however, it is in a very difficult situation because the roadbed in the city is not for its exclusive use, and it is under obligation to build an overhead railway. There are also some sections between the two cities where the tram passes through towns where the roadbed is not for the exclusive use of the railway line, and in order to make the improvements necessary to make the lines exclusive for their own use, the company must expend from Y.20,000,000 to Y.30,000,000, almost as much as is required by the Hanshin Dentetsu.

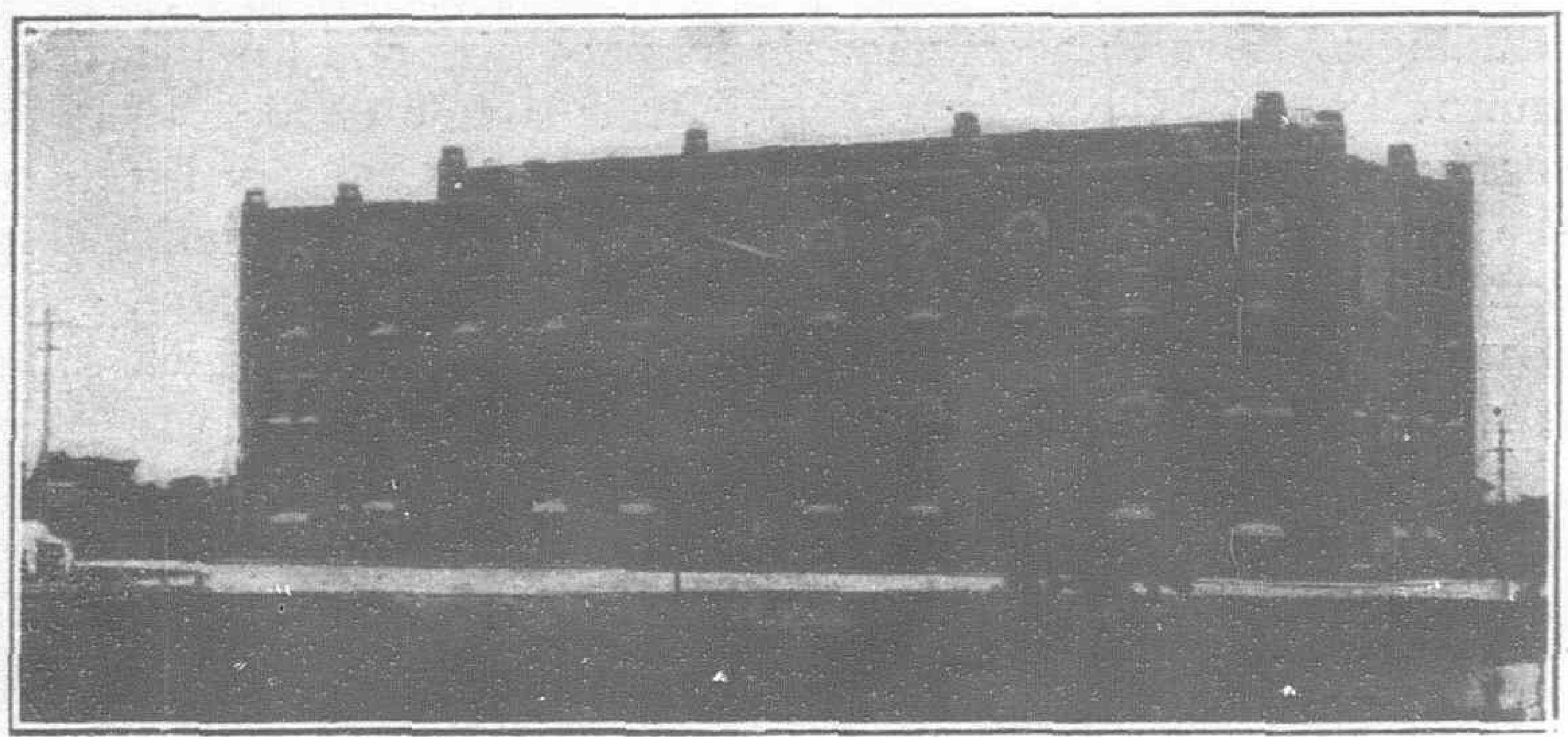
This company has consequently planned the construction of a new double-track line, called the Hokugan line. This line too needs an elevated structure on which to enter the city of Osaka, and in order to obtain an easy entrance, the company recently



Yatsuzawa Hydro-Electric Plant, Tokyo Dento



Tokyo Dento, Yatsuzawa Hydro-Electric Power Plant, Yamanoshi Prefecture



Keihin Electric Railway. Tachibana Transformer Station

bought the Joto line of the imperial government railways at the very high price of Y.5,700,000. This Joto line too must be reconstructed as an overhead railway, and will require serval millions.

Nankai Tetsudo

On the main line between Osaka and Wakayama, the roadbed having been originally constructed for the operation of a steam railway, it is possible to operate as many cars as the company wishes in one train. There are, however, fourteen miles midway between the two cities which must be double-tracked. This is now under construction. The expense is only two or three million yen, not a great problem for the company. On the other hand, the condition of all the lines of this company is very poor, and the roadbed is very much out of repair.

Hanshin Kyuko Tetsudo

In order to operate trains of two cars or more this company must build a short elevated line into Osaka city. It has still to complete its line into the centre of Kobe city, its present terminus being on the outskirts, a condition which much diminishes the number of passengers who would use the line as a fast service to Osaka. Other parts of the line must also be converted to the exclusive use of the railway. All these important changes can be completed with the comparatively small sum of Y.12,000,000 or Y.13,000,000. The reason this expense will be so low, is because the company planned for these extensions and changes from the beginning, and all construction has been carried out in conformity with this idea.

Osaka Kido

This company was originally projected with a capital of Y.3,000,000, but did not complete its construction for less than Y.8,000,000. The investing public deserted it, and it has been very difficult to stimulate popular interest in it ever since. However, unlike most of the railways around Osaka it laid 70-pound rails all along the line, except for a short distance at the entrance into Nara. Consequently this company is in a position to combine any number of cars in one train without first making any material changes in the roadbed, because of the foresightedness of the promoters.

This company is now planning and constructing a line called the Yamato line. It is not because this particular line will be very profitable, but as the dividend rates of this company are somewhat limited by expediency, the new line has been planned with the object of regulating profits, which are bound to increase as time goes on. Besides this, the plan for the new line becomes excellent material for effecting increases in the present capitalization of the company.

The future prospects of the five electric railways are somewhat as related above, and their difficulties all originated in the failure on the part of their promoters to realize the need of preparing or future expansion when the lines were first laid. The Hanshin Dentetsu for instance, was known to be building a line through the best traffic district in all Japan, still the company failed to exercise wise foresight, and consequently has brought upon itself the rivalry of the Hanshin Kyuko line, which is causing real concern to the present management. The principal reason for the defects in construction of the Hanshin is found in the machinations of a group of speculators on the Osaka exchange, known as the "Hanshinkai." The management of the company is not composed of men with real authority, but is vested in the interests of the "Hanshinkai." Consequently the whole policy of this line has been in conformity with the wishes of speculators, who are not interested in future policies, but present and immediate profits.

The Keihan Dentetsu has many plans, but its chief managers are politicians, and their efforts are always directed to securing "rights." They secured the right of building the Hokugan line, and purchased the government's Joto railways, and they are now planning an extension out towards Wakayama. But the real administrators are not men who are capable of accomplishing any betterment of existing service, in which respect this Osaka-Kyoto line is very much like the Kobe-Osaka line.

On the other hand, the Hanshin Kyuko and the Osaka Kido lines are managed by their original founders, who have taken an active interest in the management of the lines. Naturally the real power lies in the hands of the expert managers, who have no fear of having their suggestions rejected by shareholders who lack confidence in their ability.

The Hanshin Kyuko completed the Kobe-Osaka express line during a period when commodity prices were at their very highest, and yet the cost of construction was not high, judging even by prices ruling to-day, which are much below those of two years ago. This is because the work was planned during war-time prosperity, and was carried out gradually and without haste.

The original promoter of the Osaka Kido lost his position because he expended Y.8,000,000 instead of the Y.3,000,000 allowed for the construction of that line ; however, the present managing director who has been with the company ever since its foundation, is the real power in its councils.

The Hanshin Dentetsu, no matter how great its profits may be to-day, cannot stand the expense of Y.30,000,000 to Y.40,000,000 which will be necessary to reconstruct the line. The Keihan is inferior to the Hanshin Dentetsu in every way, and it, too, must spend large sums to put its lines in order. It can readily be seen, that the profits of these two companies will tend to decrease in the future.

The future of the Nankai Tetsudo is now somewhat uncertain. For a time there was talk of its being purchased by the government, but since this has died down, it is reported that the Seiyukai are trying to get some of their members the privilege of building a competing line. The roadbed of this railway is not very good, but it does not require any great immediate reconstruction. Slight improvements every year will carry it along without decreasing its profit rates.

As for the Osaka Kido, it can put into operation as many cars as it pleases on each train, without making any changes in the present roadbed. The only defect of this line is its poor geographical position, operating through a very sparsely settled district.

The Hanshin Kyuko may have to spend thirteen million yen in order to complete its present plans. Should it enter the city of Kobe, as it intends, this company should become the most important line operating in the Kansai. Viewed in this light, the most interesting feature in the future of these five big electric railways in the Kansai, is the prospects of the Hanshin Kyuko. Just at present its profits are the lowest on the list, but this condition will undoubtedly change soon.

It is thought in Osaka Kobe financial circles that if the Hanshin Dentetsu fails to make the changes needed in its roadbed, or does not soon build a new double line, through fear of decreasing their rate of profits, that it is destined eventually to be absorbed by the Hanshin Kyuko Dentetsu Kabushiki Kaisha, familiarly called by the Japanese the Hanshin Kyuko.

The Kobe-Osaka Electric Express Line

The Hanshin Kyuko railway is one of the enterprises of the Osaka-Takaradzuka Railway Company, which, between those two places with a branch line to Minomo, operates 18 miles of electric railway, and also supplies electric light and power in the vicinity of Takaradzuka and Minomo. It also conducts a real estate and building company. In 1920, the Osaka-Kobe express service line was opened, and a branch line to Itami was completed. In 1921, a new line between Nishinomiya and Takaradzuka was also finished. The present length of the company's lines is 42 miles.

The line between Osaka and Takaradzuka passes through no big towns and many districts are of such a nature that any increase in their population was not to be expected. But when the lines were completed to Takaradzuka and Minomo, many pleasure seekers were attracted to those places for the baths, and through sales of land at cheap prices, and extensive building operation the districts around these two places have gradually been developed, so that to-day the results are most noticeable in the company's business statements.

TABLE I. PAID-UP CAPITAL. PROFITS AND DIVIDENDS.

	Paid-up Capital	Profits	Dividend Rate per cent.
1918, 1st half year ..	Y. 4,400,000	Y. 301,000	8
1918, 2nd half year ..	5,390,000	397,000	8
1919, 1st half year ..	6,875,000	377,000	8
1919, 2nd half year ..	7,494,000	402,000	8
1920, 1st half year ..	12,275,000	772,000	10
1920, 2nd half year ..	12,275,000	917,000	10
1921, 1st half year ..	18,000,000	1,119,000	10

There has been a great expansion in the value of the company's property since 1918.

TABLE II. VALUE OF PROPERTY OF HANSHIN KYUKO RAILWAY CO.

	1921 1st half-year	1918 1st half-year	Increase
Construction Expenditures	Y.16,662,000	Y.6,248,000	Y.10,414,000
Building Imatsu Generating Station ..	3,742,000	—	3,742,000
Land and Buildings ..	1,127,000	677,000	495,000
Light and Power Costs of Equipment ..	2,383,000	443,000	1,940,000
Total	Y.33,959,000	Y.7,368,000	Y.16,591,000

The fixed capital of the company increased Y.16,591,000 in the three years from 1918 to 1921, but the cost of construction of the Osaka-Kobe express line, 17 miles and the Itami branch 19 miles was Y.10,414,000. The Osaka-Kobe line was begun in September, 1918, completed in 1920, and put into operation on July 16 the same year. But the results of business cannot yet be positively regarded, it is necessary to consider several other matters first.

When the Imatsu power station was first planned it was intended to build a generating station for 10,000 kilowatts, consisting of 25,000 kilowatt generators. Later it was seen that there was much disadvantage in having only two generators to operate and so it was determined to add one more 5,000-kilowatt generator to the equipment. This third generator will be kept in reserve, 10,000 kilowatts being the maximum requirement for power. This plan was adopted in the days when finance was easy, but since the hard times set in demand for power has noticeably decreased, and the boundaries of supply in which this company operates are not sufficiently extended to consume all the power that this new plant will generate. This state of affairs has naturally much upset the company's calculations, and recently negotiations were concluded with the Ujigawa Denryoku Co., by which the latter company puts up the capital to take over the plant and operate it. So the 15,000 kilowatts is to go to the Ujigawa, and the Ujigawa will supply 5,000 kilowatts to be used by the Hanshin Kyuko line. Up to the present time there has been no profit on the capital invested in this power plant, but there were debts of Y.3,000,000 which were included in the costs of construction, so it has been difficult to make any profit on the investment.

A general consideration of the expansion of equipment and income of the company will show that the reason the rate of profit has not increased during the past few years has been the cost of constructing the Osaka-Kobe express line.

TABLE III. INCOME AND BUSINESS.

(000 omitted)

1918, 1st half ..	Y.490	—	Y.134	Y.140
1918, 2nd half ..	519	—	137	137
1919, 1st half ..	673	—	152	109
1919, 2nd half ..	711	—	173	313
1920, 1st half ..	967	249	208	249
1920, 2nd half ..	898	571	221	345
1921, 1st half ..	1,029	641	426	460

It can easily be seen from this table that income is gradually increasing. Until the end of 1920 the income from the Takaradzuka line gradually increased, but it fell off in the second half of 1920, only to increase very markedly in 1921. This is a holiday-making line, and is used by merry-makers from Osaka business is usually good, but the panic of 1920 stopped a great deal of holiday spending, and the line did not recover from this until the first half of 1921 when the spring season tempted holiday seekers out to Takaradzuka again.

The Kobe-Osaka line was only opened two months in the first half of 1920, but in the second half it earned Y.571,000, and in the first half of 1921, reached earnings of Y.641,000. Unlike the Takaradzuka line the Kobe-Osaka line is not affected by the season's gaieties, and it is developing steadily in the most satisfactory manner.

Up to the first half of 1921 the rate of increase of this business was steady, and in that term the Inagawa Company was annexed in the first half of 1921 this income was about 20 per cent. of the total.

With the object of harmonizing its whole income the company carries a large amount of temporary loans, to keep down dividends.

Like other light and power companies operating electric railways it is necessary to look at from the point of view of its income from the railways it operates. In 1921, first half, the income from the Takaradzuka line was Y.1,029,000 and from the Kobe line Y.641,000. The income from the Kobe line was 63 per cent. of that from the Takaradzuka line, but the number of persons traveling is greatly different.

TABLE IV. PASSENGERS ON ELECTRIC RAILWAYS.

	Takaradzuka Line	Kobe Line
1918, 1st half	5,002,000	—
,, 2nd half	5,109,000	—
1919, 1st half	5,759,000	—
,, 2nd half	6,465,000	—
1920, 1st half	7,009,000	828,000
,, 2nd half	6,556,000	2,226,000
1921, 1st half	7,728,000	2,584,000

In 1921, first half, the number of passengers on the Kobe line was not one-third of that traveling on the Takaradzuka line but the income was 63 per cent. There is room for a great expansion of population along the Kobe-Osaka line which does not run through the main populated villages, but lines rather far away from such towns as Nishinomiya, Koroen, Ashiya, Sumiyoshi, etc., so that the future of this line is extremely promising.

Speaking of the Kobe-Osaka line it is necessary to call attention to the fact that there are many electric lines in the suburbs of Osaka which were laid down very carelessly along the lines of touching the districts in which most passenger were to be found. They were built along the main streets, and now when traffic has increased so enormously can no longer operate at high speeds. The new line warned by these examples owns its own roadbed, and nowhere uses the public roads. Its roadbed, rails, wire carriers, and in fact, all its equipment is of the latest standard, and finest make, and cars can accordingly be run at very high speed. The time on this line between Kobe and Osaka is only 40 minutes, while on the Hanshin electric railway, a separate company, it takes an hour between the two cities. In the first half of 1921 the Hanshin electric carried between the terminals at Kobe and Osaka 2,600,000 passengers. The Hanshin Kyuko about half that number of through passengers. The reason so many passengers patronize the Hanshin electric instead of the Hanshin Kyuko is because the terminal in Kobe is in the heart of the city. The Hanshin Kyuko terminal is in the suburbs and very inconveniently located. It is now necessary to build into the city itself, but because of a plan the municipality has for beautifying Kobe city, the railway company must enter by an underground line which will cost a prohibitive sum, and take too long a time. A request has been presented to the authorities that they permit the construction of an elevated line instead.

This will take three years to build. But it will have its terminal in Motomachi 1-chome, near Sannomiya station. And because of some street plans of the city of Osaka the company will also have to build an elevated into the heart of the city of Osaka from Jussan. This line will have a double track. Expenses of constructing the elevated in Kobe are estimated at Y.7,000,000, and from Jussan to Osaka Y.3,500,000, to which preliminary expenses of Y.500,000 must be added, bringing the total to Y.11,000,000. To raise this sum the capital must be increased, but if this is done the rate of income will not be sufficient to attract capital. So it is planned to raise a company loan which will pay 8 per cent. interest. This will be cheaper than raising capital, which nowadays requires at least 10 per cent. returns in order to be attractive to investors.

The following statement of the liabilities and assets of the company was published at the end of the first half of the fiscal year 1921 :—

TABLE V. ASSETS.

Unpaid Capital	Y.6,000,000
Construction Costs	16,662,128
Imatsu Generating Station Construction Costs ..	3,741,637
Cost of Land and Buildings	1,172,005
Land and Buildings sold oni nstalments not yet paid	954,187
Power and Light Equipment	383,245
Tools, etc.	15,959
Goods in Warehouses	393,447
Bank Deposits	234,288
Negotiable Securities	23,442
Temporary Payments	43,939
Uncollected Income	89,032
Cash on hand	20,974
Total	Y.31,734,337

TABLE VI. LIABILITIES.

Capital	Y.24,000,000
Company Debentures	2,000,000
Legal Reserve	352,200
Special Reserve	181,500
Dividend Equalization Reserve	200,000
Reserve for Bonus	52,898
Deposits of Company Employees	70,820
Money Deposit for Character Guarantees	30,936
Temporary Loans	3,000,000
Temporary Petty Loans	155,397
Unpaid Dividends	26,980
Unpaid Interest on Debentures	61,009
Other Unpaid Accounts	277,073
Carried over from Previous Term	206,805
Profit for the term	1,118,716
Total	Y.31,734,337

The future estimate of business counts on 10,000 passengers a day riding between Osaka and Kobe. If this is possible to realize then it will not be difficult for the company to pay a dividend of 10 per cent., even if it is necessary to borrow enough money to pay for the improvements required in Kobe and Osaka. These passengers will pay 40 sen each, and the profits from the traffic is expected to increase Y.500,000 a term. This will be a sum sufficient to meet all interest charges and leave a slight balance for payment of dividends.

Taking into consideration the important industrial district through which the new Kobe-Osaka runs, the future of the line should be very promising indeed. As the lands fill up with factories and home makers the company's revenue will increase from passenger service, freight service, light and power service, and from the sale of land and buildings on the instalment plan. The Takaradzuka pleasure resort grows more popular every year, and will eventually become one of the greatest pleasure resorts in the Far East when all the improvements planned are instaled.

Iron Ore in the Malay Peninsula

IN the report for 1920 of the general adviser to the government of Johore, mention is made of the opening of an iron mine on the left bank of the Batu Pahat River, a mining concession over 50 acres having been issued to a Japanese. The ore is mainly hematite, containing about 65 per cent. of iron, and there is sufficient ore in sight for five years' working. Later information to hand, down to the end of September, shows that the deposit is being actively worked, and the monthly output is now 8,500 tons of ore of excellent quality. The ore is being shipped to Japan. It is reported officially that similar deposits are known to exist in Johore and other parts of the Malay peninsula. As regards the question whether the ore can be produced at a price that would find for it a ready market, Mr. Isheharo, managing partner of Nanyo Kogyo Koshi, who is in charge of the mining operations at Bata Pahat, has contributed an article to a Singapore newspaper in which he states that hematite ore is the commonest form in Malaya. Magnetite is also found in some quantity, but limonite is less frequent. He discusses the possibility of smelting the ore in Malaya, and arrives at the conclusion that, at present at least, it would be useless to attempt to smelt the ore locally. The price for which the ore can be sold in India is given as $2, in China $3 and in Japan $8—the value of the Straits Settlement dollar being 2s. 4d. If exported to India or China, the price would not be enough to pay for the freight ; but if a specially low rate were given to Japan, it would be possible to dispose of the ore there at a profit. Japan's requirements are 1,200,000 tons of ore yearly. Half of that amount is already mined in Japan, and the remainder has hitherto been supplied by China. These ores contain from 50 to 60 per cent. of iron, and are bought at $8 per ton, whereas the ore from Malaya contains 65 per cent. and is worth about $10.50, though it has been sold at $10 in order to compete with ore from other sources. The usual freight to Japan is from $7 to $8 per ton, and other expenses are about $3 per ton. At these rates, it is obvious that it would be impossible to mine and market the Johore deposits at a profit, so the Japanese company charters steamers which would otherwise be returning in ballast to Japan. In the course of a year some 50,000 tons of cargo space is available in this way and the Japanese miners are able to export the ore at the freight of $5.50 per ton.

The University of Hongkong

The Work and Equipment of the Engineering Faculty

By C. H. MIDDLETON SMITH

THE importance of technical education in China is more appreciated to-day than it was a few years ago. The purpose of the engineer is to develope the vast resources of nature for the use and convenience of mankind. That China possesses vast natural resources will probably not be disputed. Everyone who has traveled through the various provinces has been impressed by the evidence of latent mineral wealth. Experts who know China are enthusiastic on this subject. They see that not only is there immense latent mineral wealth, awaiting liberation in order to benefit greatly the world and China—and China most of all; there are also vast possibilities of improving the vegetable wealth by the application of scientific knowledge in the way of water supply, transport, etc. China offers, at hand, an almost inexhaustible army of intelligent and most industrious workmen. What then is retarding the development of the great natural resources of the country when it is so obviously to the benefit of everyone that these resources should be made available for the use and convenience of mankind ?

SIR WILLIAM EDWIN BRUNYATE, K.C.M.G.

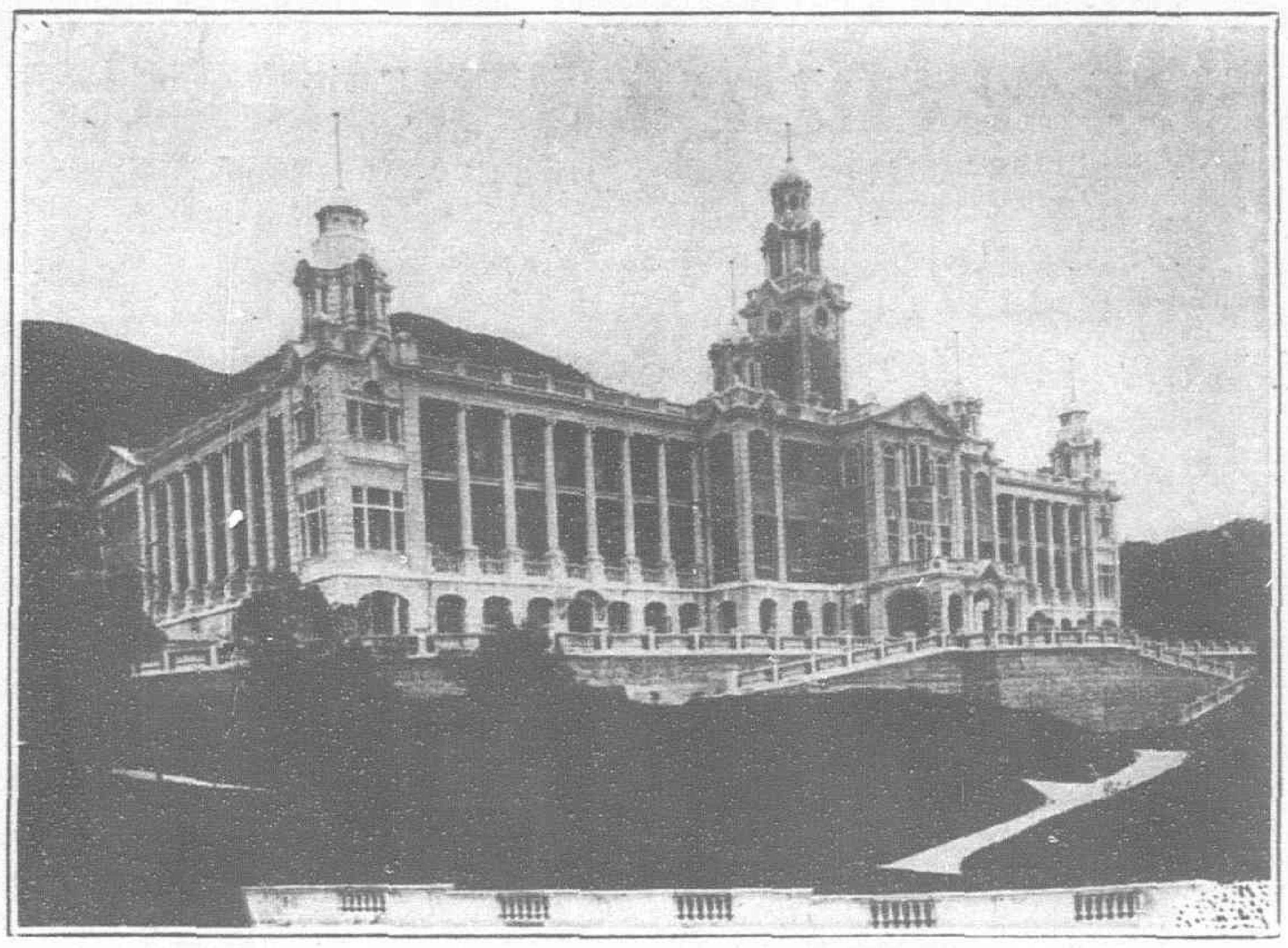
Vice-Chancellor and Principal of the University of Hongkong

The answer is quite simple. This greatly desired utilization of the gifts of nature has not yet taken place because of ignorance. It is useless to regret; sometimes it is waste of time even to enumerate the past mistakes of nations or individuals. The practical man accepts the present position and wastes neither energy nor time over regrets, but sees what is desirable and works for that end.

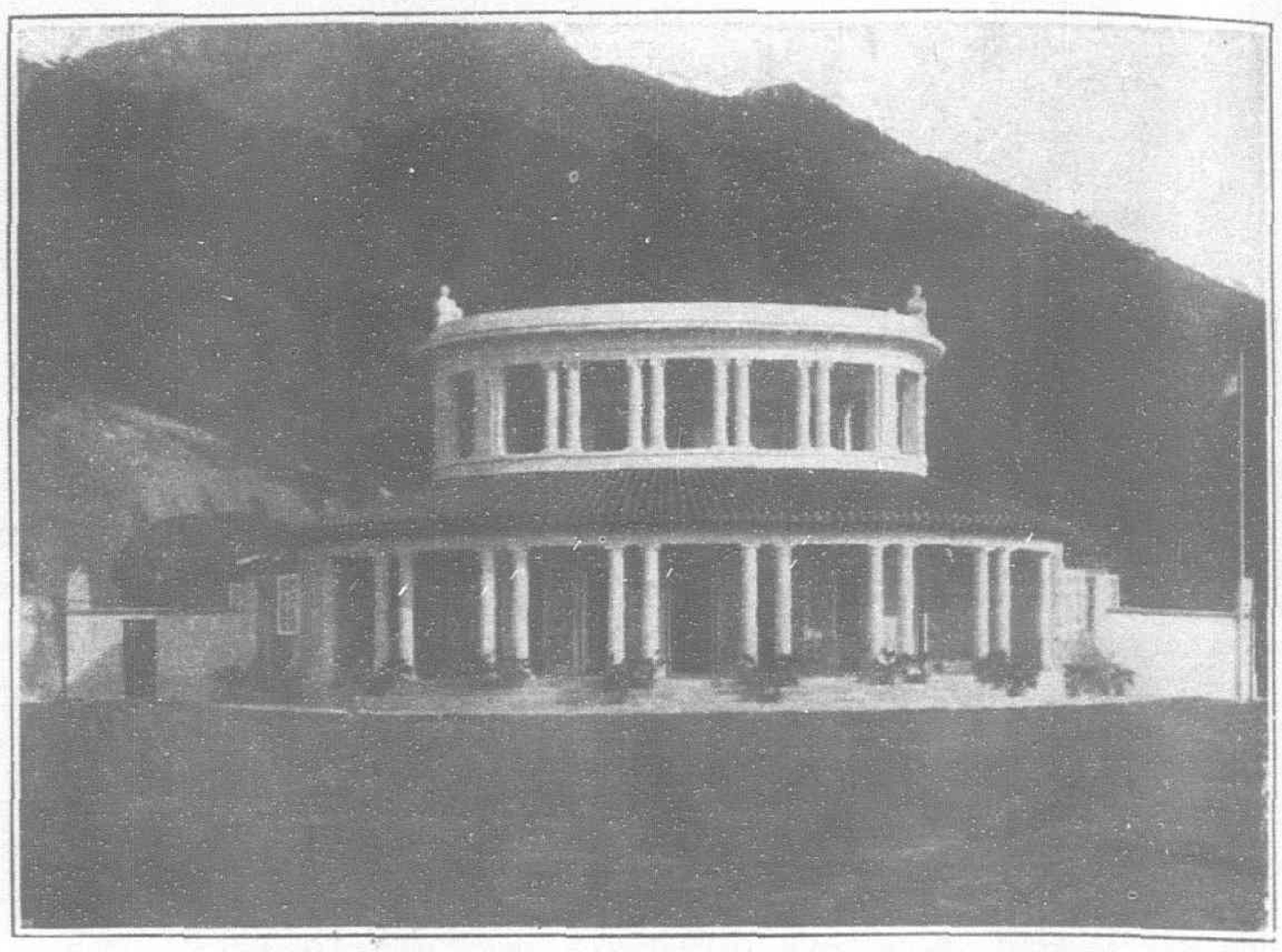
Until quite recent times the Chinese have been entirely ignorant of modern scientific methods. Even to-day only the merest fraction of one per cent. of the population have any notion of what is meant by the word "Engineer." The number of Chinese technical men qualified by training and experience to become full members of the British institutions of civil, mechanical or electrical engineers is probably less than a hundred. Yet the population of China is estimated at about 400,000,000. There are probably nearly 10,000 British professionally qualified engineers (out of a population so much smaller) corresponding to China's one hundred. There are, it is true, a number of young Chinese who have been trained in engineering in Europe or America during the last twenty years and some of them are doing excellent work. In due time they should acquire the experience needed in order to carry out with success some of the more urgent engineering schemes in China. Their weakness is usually inexperience, and a training not always very suitable for the peculiar conditions that obtain in China. It is not too much to say that with settled political conditions and a more general appreciation of scientific work on the part of government officials and bankers, there would be useful employment for hundreds of thousands of Chinese professional engineers in the vast territory of their own country. Foreign engineers will for many years be needed to give advice as experts on special problems, but the natural resources of China will never be developed until the Chinese themselves understand and can carry out engineering projects.

An Object Lesson

A few months ago an engineer whose fame is world-wide addressed the students of the University of Hongkong. Sir Maurice Fitz Maurice, although visiting Hongkong to give expert civil engineering advice on problems connected with the harbor, showed great interest in the aims and work of those giving and receiving technical education at the local university. He remarked that never, in all of his world-wide travels, had he visited a place where there were, within a short distance of each other, so many different examples of the work of the engineer. He said that, within about three or four miles of the hall in which he was speaking, there were three large and up-to-date dockyards, in two of which ocean-going ships were being built, while the third undertook the repairs of the largest ships on the Pacific. There were also, he said, a number of small engine and ship-repairing yards. Other works that he mentioned were the four quite big electrical power stations—two using steam turbines, one with slow-speed reciprocating engines and the other working with gas engines. Then he mentioned the various activities of the very efficient local public works department. The splendid motor roads, built in the face of almost insuperable difficulties; the water supply system with its various reservoirs; and the great dam at Tytam, the biggest thing of its kind East of India; the many modern factories whose products range from cement to cigarettes or from rope or leather; the steam railway on the mainland with its locomotive works and the unique cable tram that hauls a coach by means of a wire rope up to a height of about 1,200-ft.; the electric tramways on



Hongkong University, the Main Buildings
(These buildings include lecture rooms and laboratories. Residential quarters are within a few minutes' walk)



Hongkong University, the Athletic Pavilion
(This is a building situated on the Recreation Ground which is about half-a-mile distant from the University main buildings). The University sports, cricket matches, tennis and other competitions are notable part of student life)

the island and the automobile repair shops such as are to be found only in four or five places in China; the sight of the seaplanes, the wireless masts and the great variety of shipping in one of the finest harbors of the world; the reinforced-concrete buildings, the ice-factory and the systematic drainage and public health work; all of these things, and many others, were mentioned by the famous expert as object lessons and inspirations for the young engineer in training in Hongkong.

The Engineering Graduates

It should be explained that the purposes of some of the founders of the university were made evident by the fact that the first chair founded at Hongkong was the Taikoo chair of engineering. For a whole year 1912-13 there was only one professor in the university and his work was engineering. In that first session fifty-four undergraduates enrolled in the faculties of medicine, engineering and arts and of those fifty-four no less than thirty-seven elected to take the engineering courses.

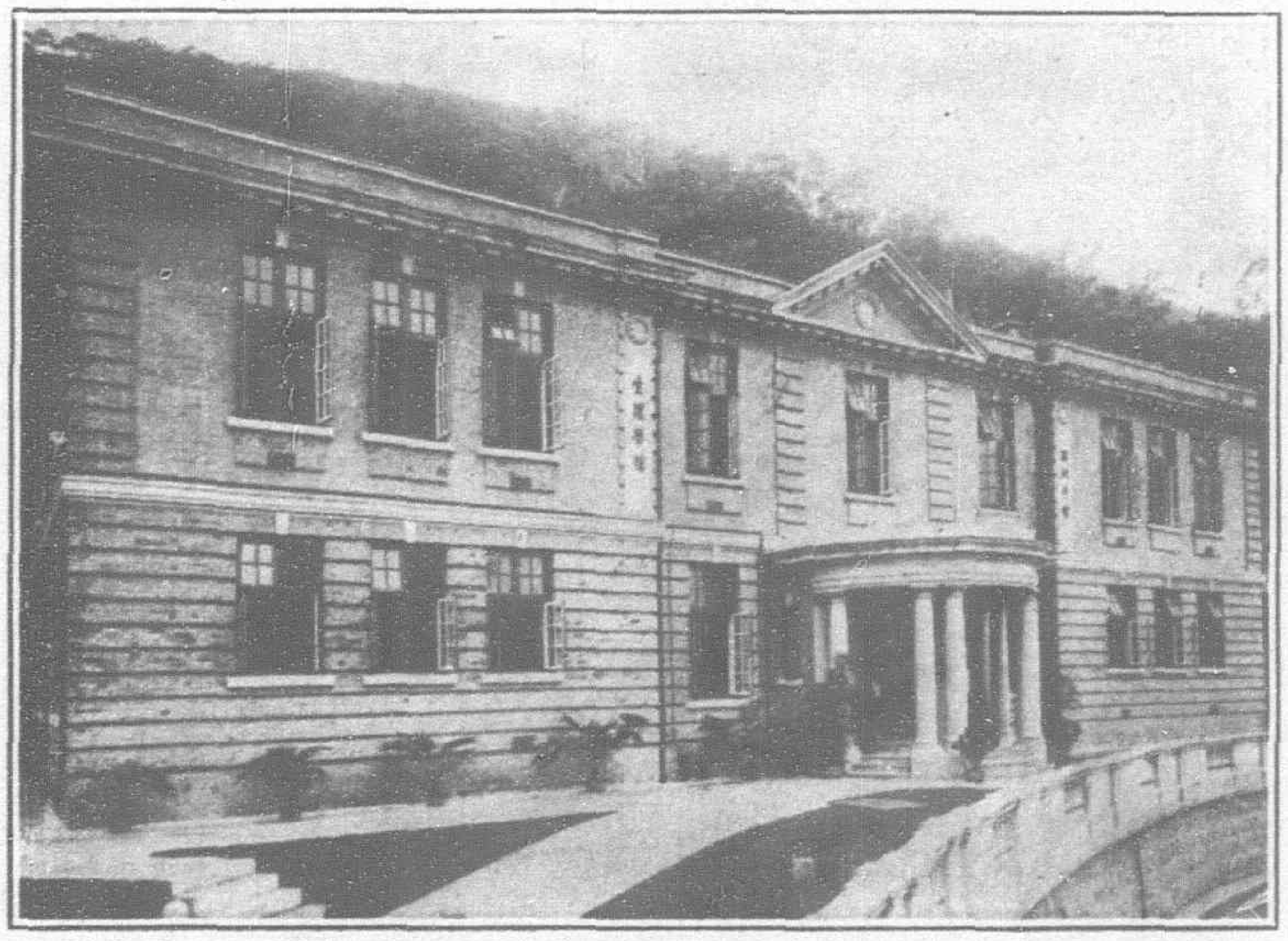
At present (1922) there are 132 graduates of the university who have passed the necessary examinations. Of those the graduates of the various faculties are as follows: Medicine, 46; engineering 77; arts 19.

Of the engineering graduates 42 specialized in civil engineering, 16 in mechanical engineering and 19 in electrical engineering.

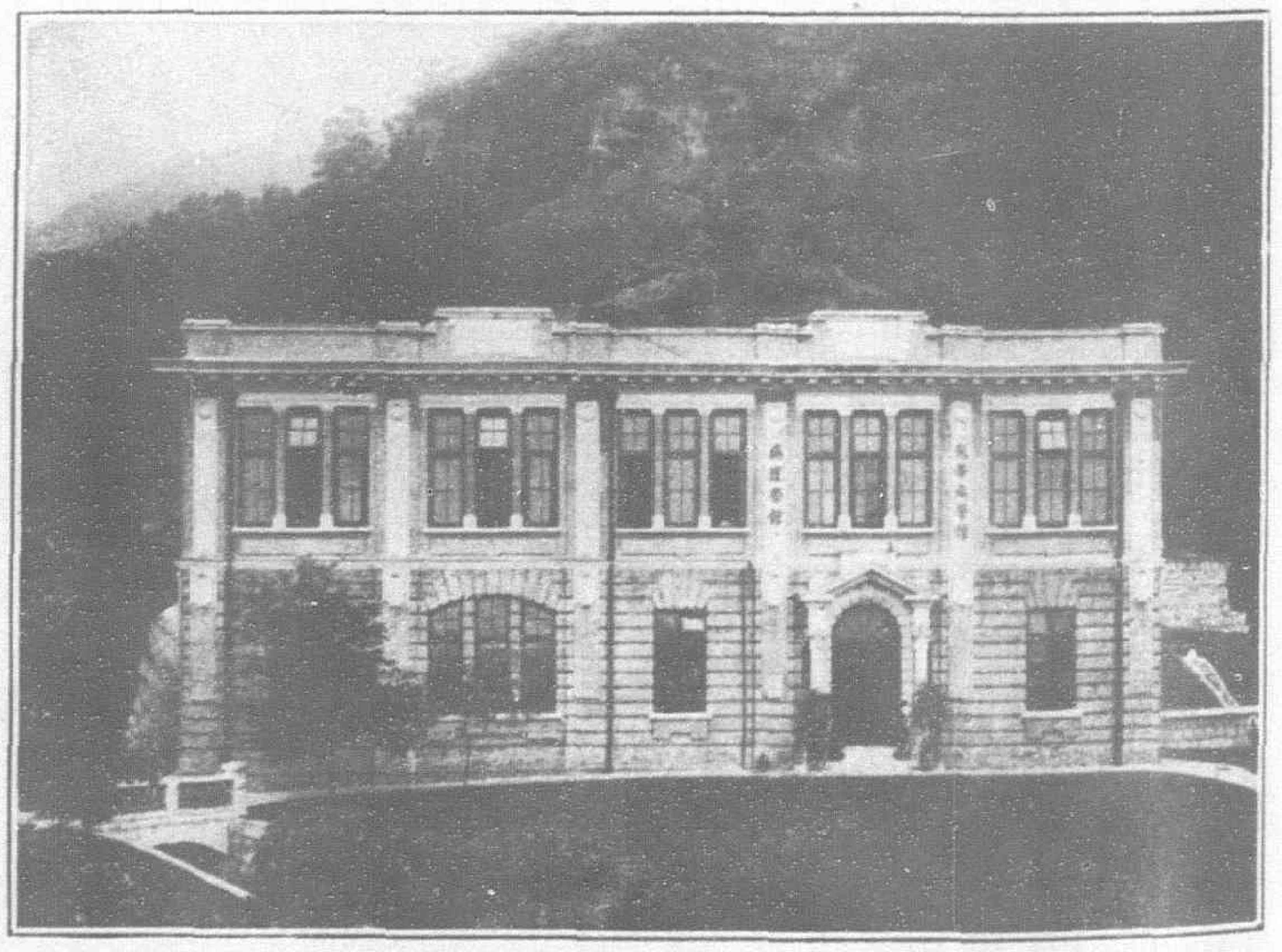
Of the engineering graduates, five have been awarded first-class honours degrees, and 18 second-class honours. These awards are made on the recommendation of examiners of the University of London who have certified that the honors standard of the engineering degree of the University of Hongkong is the same as that of the University of London.

The details of the work done by the engineering students will be given later. Suffice is to say now that, in general, the technical instruction given at Hongkong is similar to that given in the University of London. The only differences are these. In London the course after matriculation can be completed in three years whereas in Hongkong the course takes four years. That is to make allowance for the defective teaching of science in the Far Eastern schools which act as feeders to the University of Hongkong and also because of the language difficulty and the entire novelty of any engineering work to the majority of Far Eastern students. In London the engineering student is allowed a free choice of certain engineering subjects in his final examinations. In Hongkong he must study the elementary work of civil, mechanical and electrical engineering in his first three years at the university. During his final year he selects to specialize either as a civil, mechanical or electrical engineer. In actual fact some students have elected to stay a year after graduation in order to study one of the other courses.

The object of this arrangement is fairly obvious. In an undeveloped country, such as is China, it is essential that every



University of Hongkong, Medical Buildings, Schools of Anatomy and Physiology



University of Hongkong, Schools of Tropical Medicine and Pathology

engineering graduate should know the elements of the three branches of engineering. In his work the civil engineer needs to know how engines work and the principles of various mechanisms as well as requiring a knowledge of electric power. Similarly the mechanical or electrical engineer needs to know the principles for the design of structures, etc.

The engineering students of the University of Hongkong have come from all parts of the Far East. They have traveled to their *alma mater*, from Penang to Peking, from Java, Siam, Australia, India, and other lands and from nearly all of the eighteen Chinese provinces but especially from Yunnan, Chihli, Hupeh and Kwangtung. Mostly the sons of merchants, some of them come from families of officials. Some of them, especially those from the Malay Federated States, cannot speak Chinese at all; many of them speak Chinese dialects which are intelligible only to those of their fellow students who come from the same districts. All of them speak and write English, for the entrance, or matriculation examination is conducted in English with various compulsory papers to test especially, their knowledge of the English language. All of the technical lectures and instruction is given in English.

The Beginnings

As we glance rapidly over the history of the nine years since, in 1912, the university opened its doors to students, it seems almost incredible that so much has been accomplished. It is not proposed to go over the full story of the inception and the working out of the idea of technical instruction in Hongkong. That is to be found in the university calendar which is published annually and which may be had on application to the registrar of the university or the dean of the faculty of engineering. There are, however, a few facts of interest not set forth in the calendar and one or two of them may be related.

Firstly, it may be acknowledged that when the university opened its doors in 1912 its financial resources were entirely inadequate for the work which it was proposed to do. After ten years its annual revenue is almost four times as great as it was in 1912 and that fact of itself demonstrates beyond cavil that there are people in China who wish to encourage and develop this institution. It would be foolish to suggest that the technical departments of the university do not require further funds; there is probably no technical institution in the world that does not wish to improve its equipment and work; in China, more than any other part of the world, there is the possibility of enormous expansion in technical education. In the University of Cambridge, England, there are now about 1,100 engineering students as compared with, say, 200 in pre-war days. In the University of London the number of engineering students is probably four or five times as many as were at work there ten years ago. In the universities in America the engineering graduation classes include many hundreds of students. As the facilities at Hongkong are improved, and the opportunities for studying engineering are more generally known, there will be many hundreds (perhaps thousands, of technical students. At present about twenty new students are enrolled in the engineering faculty each year and the total number of such students is under a hundred. Let us now consider the work which they do during their four years of study and the type of life they lead during their careers as undergraduates.

The Training

Although students not studying for a degree may be admitted to lectures and technical instruction, the experience of the past ten years has proved that very few students take the engineering courses except with the hope of obtaining a degree. Throughout the four years' course the engineering student spends about two hours each day at lectures and four hours in the laboratories, workshops or drawing office. The first two years are occupied in instruction in physics, chemistry, mathematics and mechanical engineering.

In the third year the student spends the whole of his time at work in the subjects called prime movers, materials and structures and electrical technology. These are really the basic subjects needed in mechanical, civil and electrical engineering. Surveying is also done by certain students.

In the fourth year the course is more specialized. The future civil engineers take structures, surveying and hydraulics. The future mechanical engineers take prime movers, electrical generation and distribution and design of engines and machines. The students specializing in electrical engineering take the first two subjects in common with the mechanical engineers and electrical design as a third subject.

The Cost of Technical Education

It must be confessed that the original promotors of the university did not realize that modern engineering instruction requires a great deal of money to be spent on buildings—especially designed as laboratories and workshops equipment and staff. Let it be assumed for a moment that there is no technical education in Hongkong and that it is proposed to create only a school of engineering (civil, mechanical and electrical) of a university type. The following is a rough estimate of the cost:—

First of all a site for a building is needed, giving a ground floor area of about 50,000 sq. ft. (say 115 acres) for offices and buildings for instructional purposes. To put it in another way, the present floor area actually occupied by the lecture rooms, drawing offices, laboratories and workshops used by the engineering students (including physics and chemistry rooms) is 29,200 sq. ft. Plans are in preparation for extensions which will cover a floor area of about 45,000 sq. ft. In these days of increased cost of buildings these various rooms, laboratories offices and staff and students' residences for the faculty of engineering only would cost about a million and a quarter dollars. There is also the site, which would be very costly.

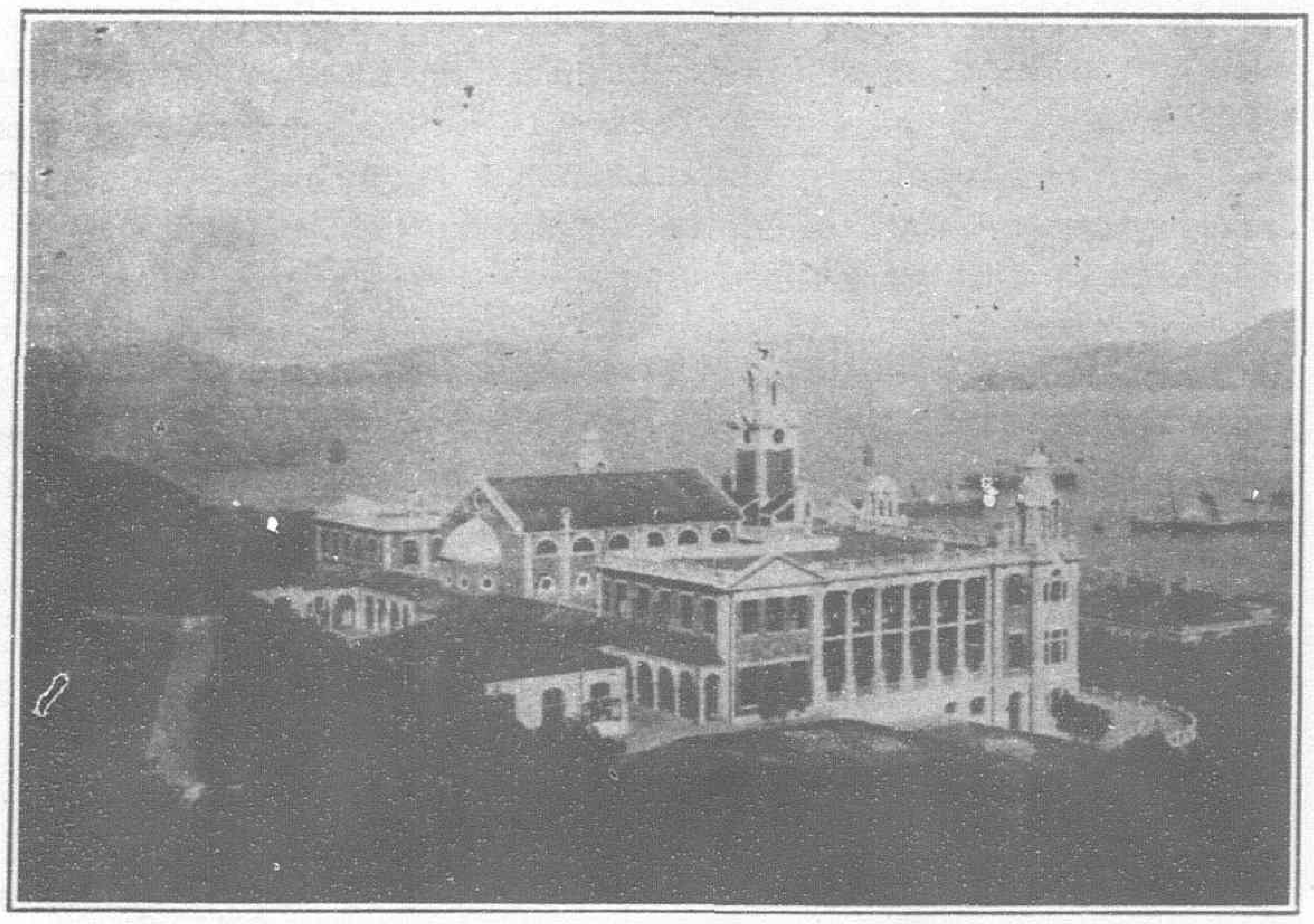
The present equipment now used by the engineering students may be valued at £40,000 and it is hoped to increase the equipment by machines valued at £20,000, in the near future.

Students' common rooms, residental quarters, recreation grounds, etc., also cost money.

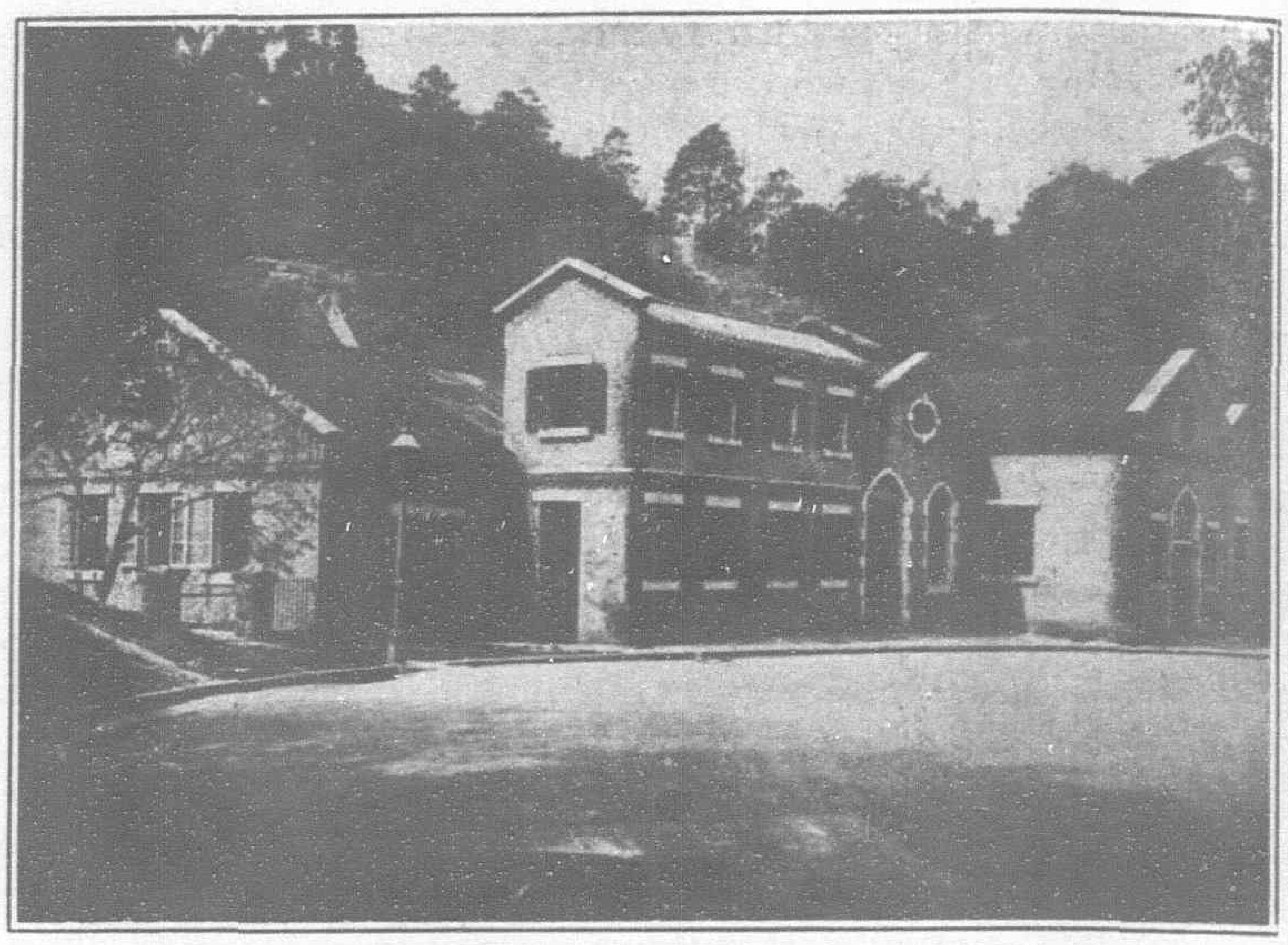
To re-create a school of engineering at Hongkong such as exists to-day would cost about 2½ million dollars for capital outlay on land, buildings and equipment together with a capital sum of at least one million dollars for endowment purposes for payment of staff and general maintenance of buildings and equipment. That is assuming that there would be as at present, a steady income from students' fees which are $300 a year for instruction and $240 a year for board and residence. A solely technical institution is less educative than a university which includes students in medicine, arts, education and commerce; it cannot be sufficiently emphasized that the student learns lessons about life by meeting students of other branches of learning. We have, however, no space to elaborate on the cost of a modern university.

The balance sheet and accounts of the university at December 31st, 1921, were published and we have made a few interesting excerpts. The total assets are given as $4,365,498, of which buildings and equipment total $1,359,150 and investments (for endowments) $2,899,061. We very much doubt whether any other educational institution in China, with the exception of the Union Medical College of Peking, has such a strong financial bases as an endowment fund of nearly three million dollars, in addition to buildings, equipment, etc., valued at $1,359,150. The land is not regarded as an asset, and its value is therefore in the balance sheet as it is in reality a trust; but a conservative estimate of the value of one million square feet at West Point, Hongkong, is one million dollars.

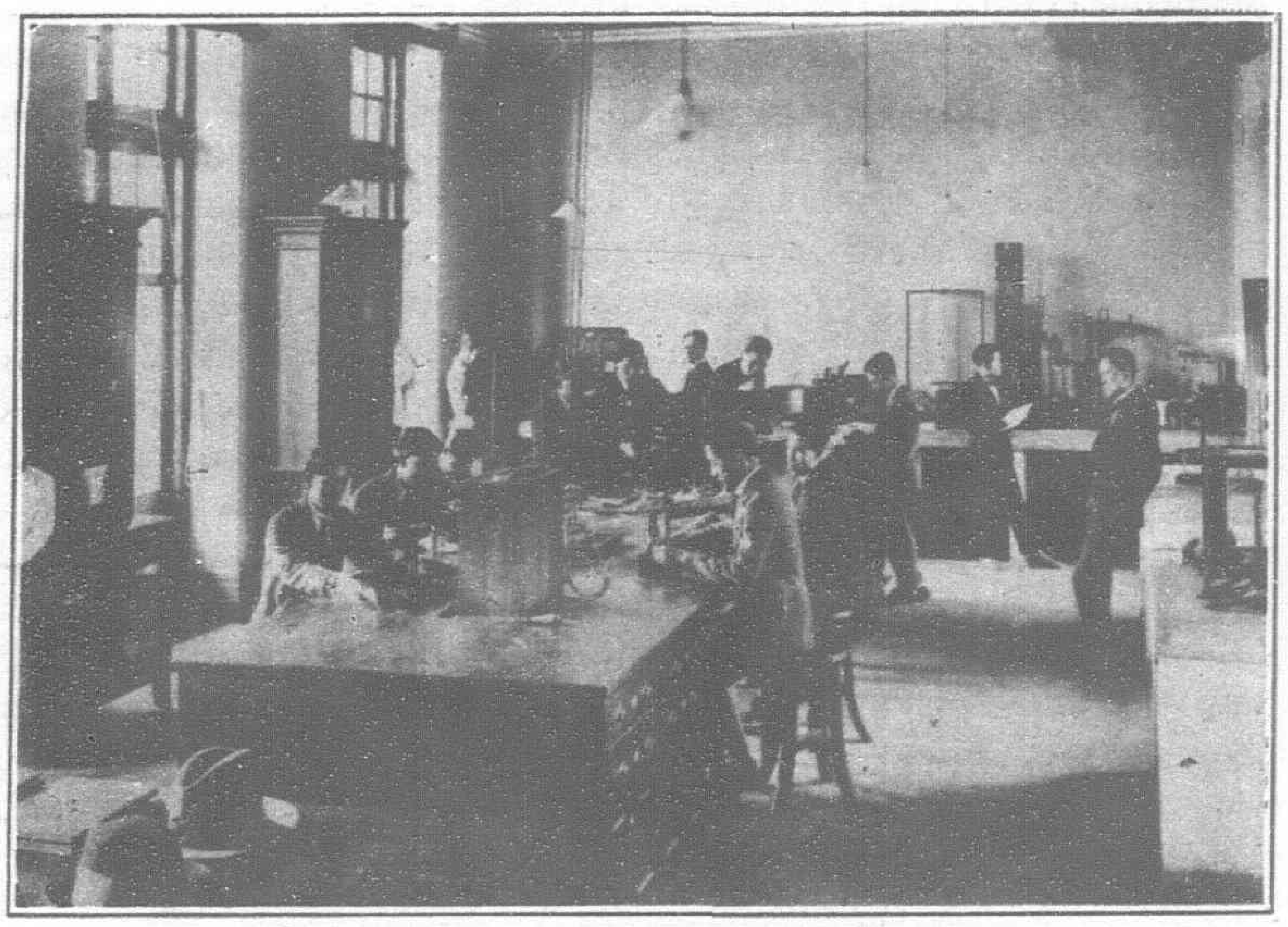
The annual income during 1921 seems to have been nearly $400,000 and it is worth nothing as an indication of the progress that, in 1914 (eight years ago) the annual income was less than $150,000.



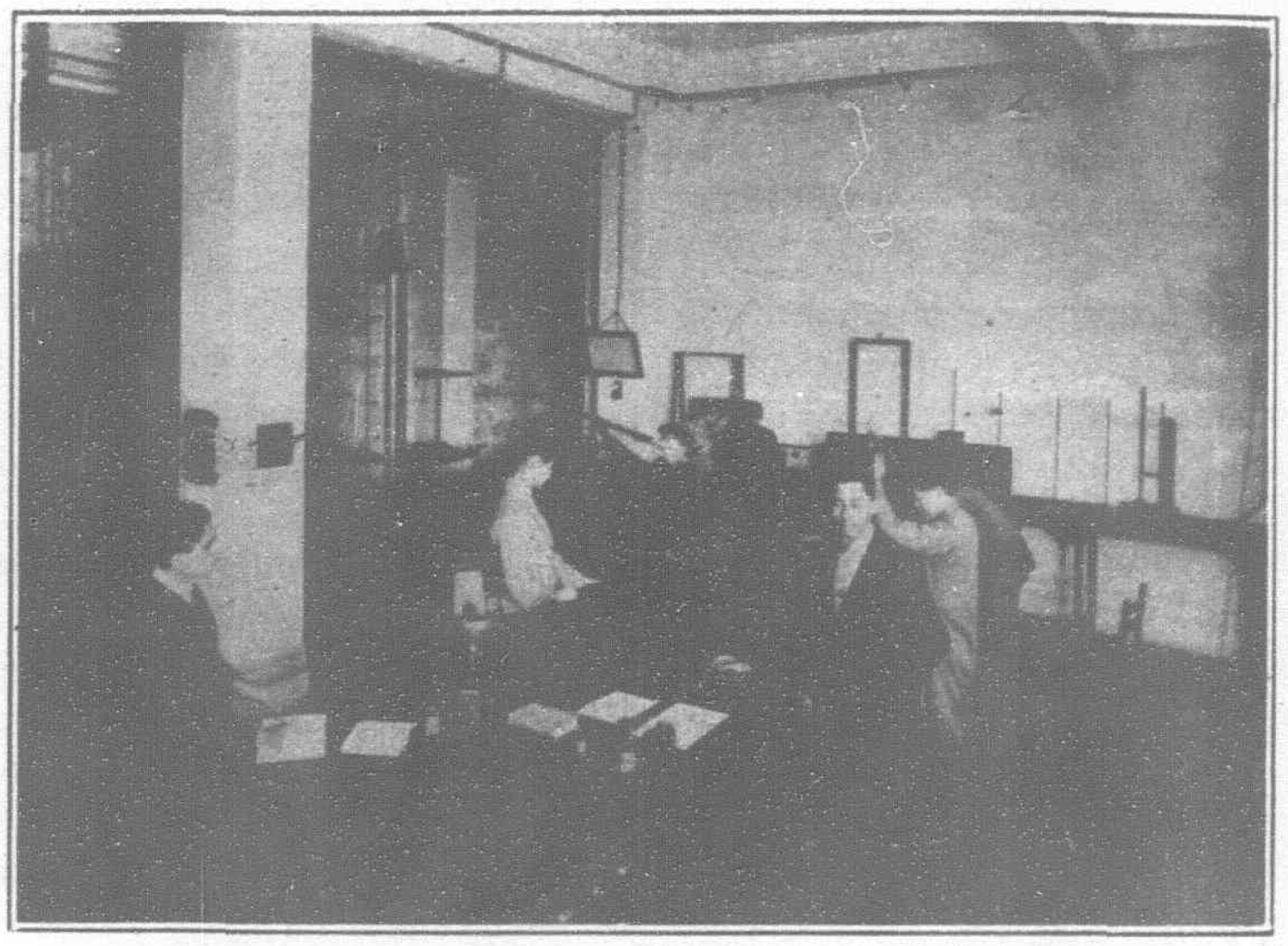
University of Hongkong, General View of the Main Buildings



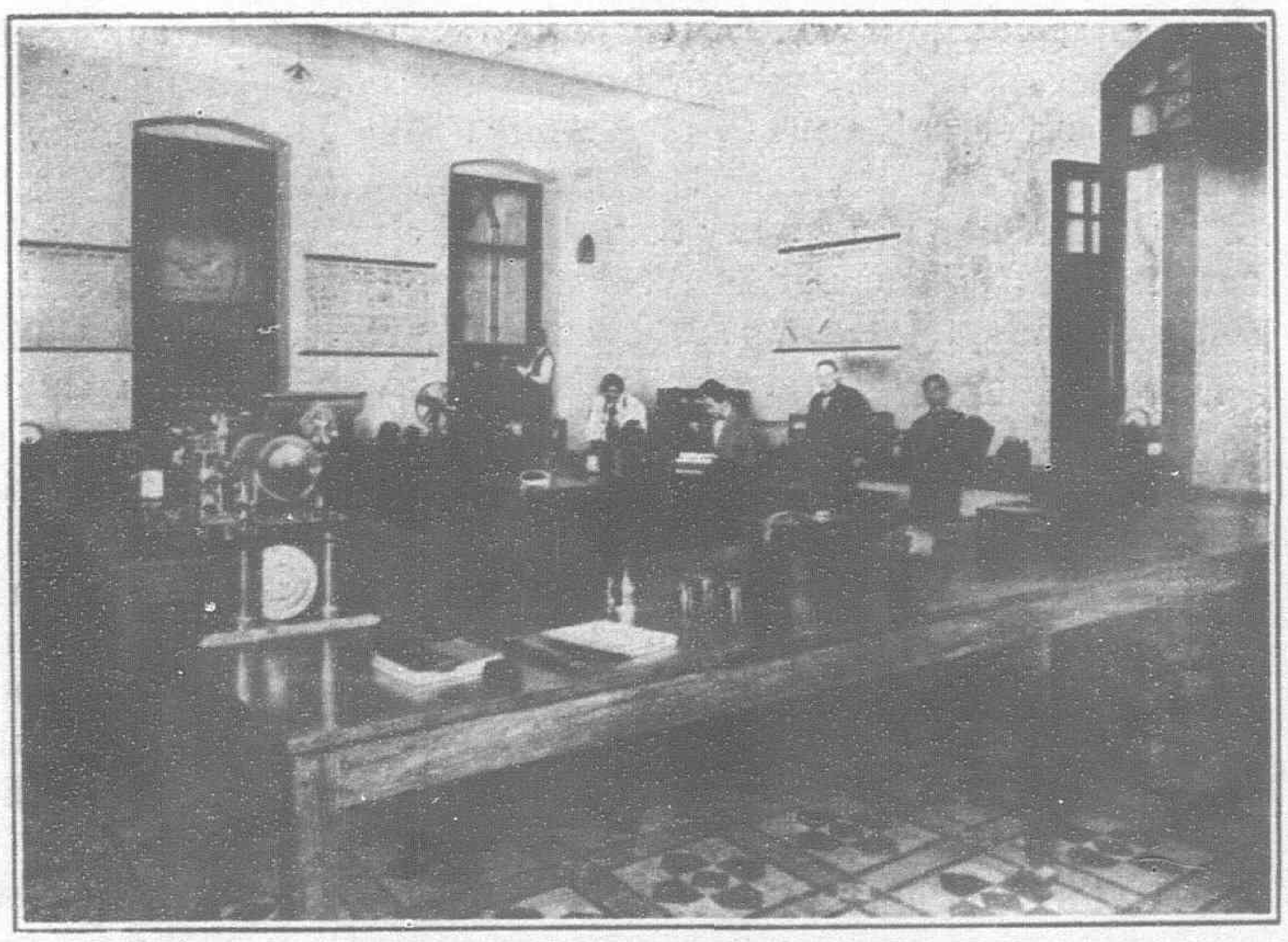
University of Hongkong, Steam and Hydraulics Laboratories



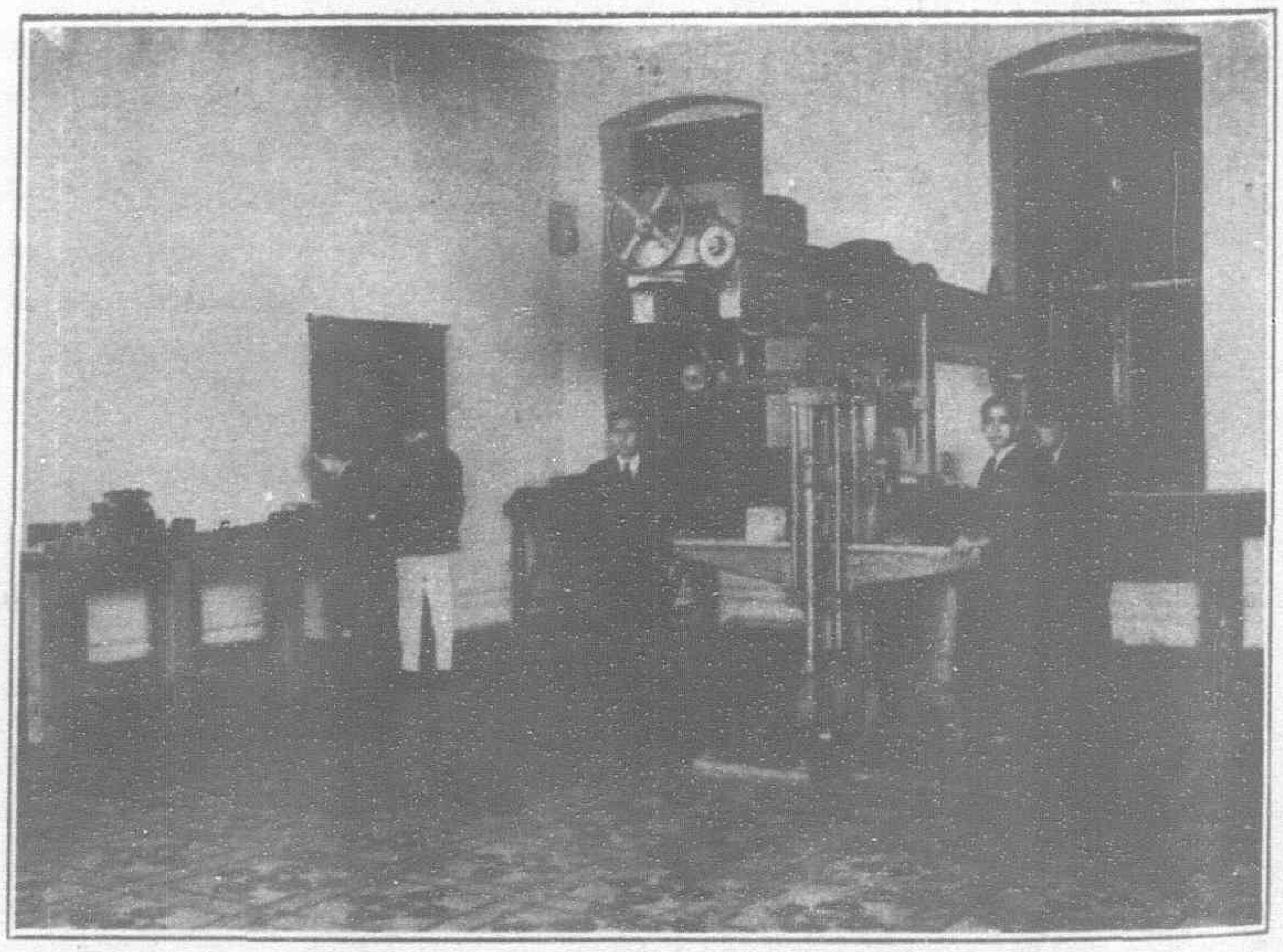
Hongkong University, Physics Laboratory
(This picture shows engineering students in the early stages of their training at work in the physics laboratory)



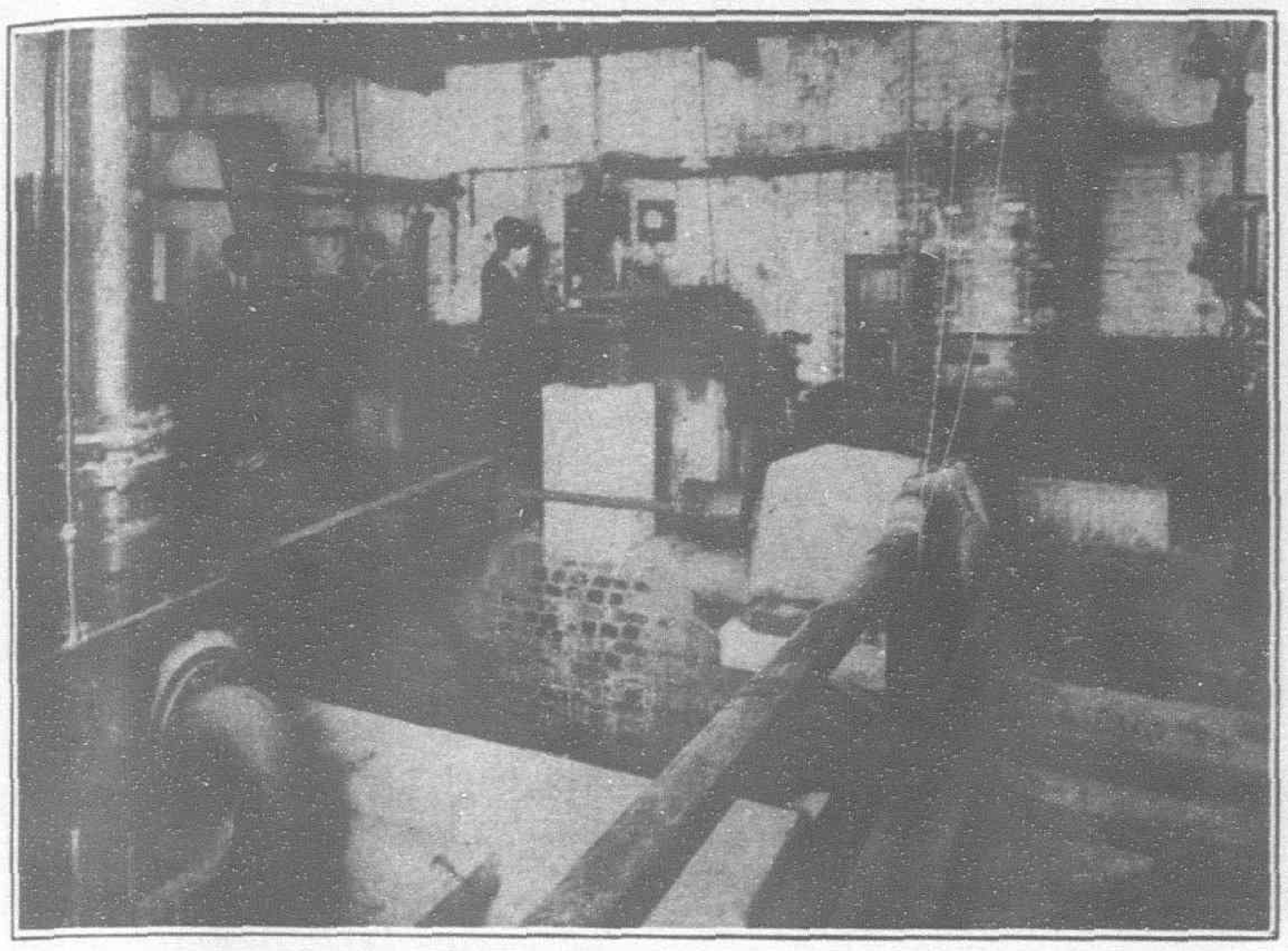
Hongkong University, applied Mechanics Laboratory
(Engineering students are here seen making experiments in applied mechanics. This work teaches them technical terms and applied mathematics as well as general engineering principles in their first year)



Hongkong University, the Electrical Technology Laboratory
(In this laboratory experiments in connection with measurements of resistances, small cements and instrument tests are carried out)



Hongkong University, Strength of Materials Laboratories
(This picture shows a 30-ton testing machine which is electrically controlled)



Hongkong University, the Hydraulics Laboratory
(Students are here seen testing a small Pelton wheel and electrically driven centrifugal pump. Other pumps, tanks, channels, etc., provide further experiments)

The engineering faculty has been fortunate in obtaining practical support. Messrs. Butterfield & Swire, Ltd., and associated firms, gave £40,000 to the original endowment fund and have since presented $100,000 for the engineering work. The Taikoo chair is named after the firms. Sir Robert Ho Tung has recently given $100,000 for new workshops.

These figures have been quoted, not with any intention of suggesting that the endowment fund is adequate or that further money is not required. In actual fact plans are being prepared for extensions of the engineering laboratories and workshops which will require at least half a million dollars for completion.

Fortunately there is, at present, no need to duplicate this great expense on behalf of technical education. It is possible to increase the accommodation in Hongkong for 500 technical students at some additional expense but at nothing like the expense involved for even two similar schools of engineering with only a hundred students each. One hundred students can listen to a lecture as attentively as ten of the subjects is interesting.

Excluding the professors of physics, chemistry and mathematics, there are at present seven full-time professors and lecturers, a workshop instructor and a demonstrator (all from England) on the staff of the engineering faculty. They hold the same qualifications as the staff in similar positions in the universities of England. There are also Chinese graduates as demonstrators and a number of workmen needed for maintenance of equipment and the electricity supply system for the whole university.

It must be remembered that in addition to the technical staff there is the general administrative staff of the university including the vice-chancellor, and the registrar concerned with all three faculties of the university.

Workshops and Laboratories

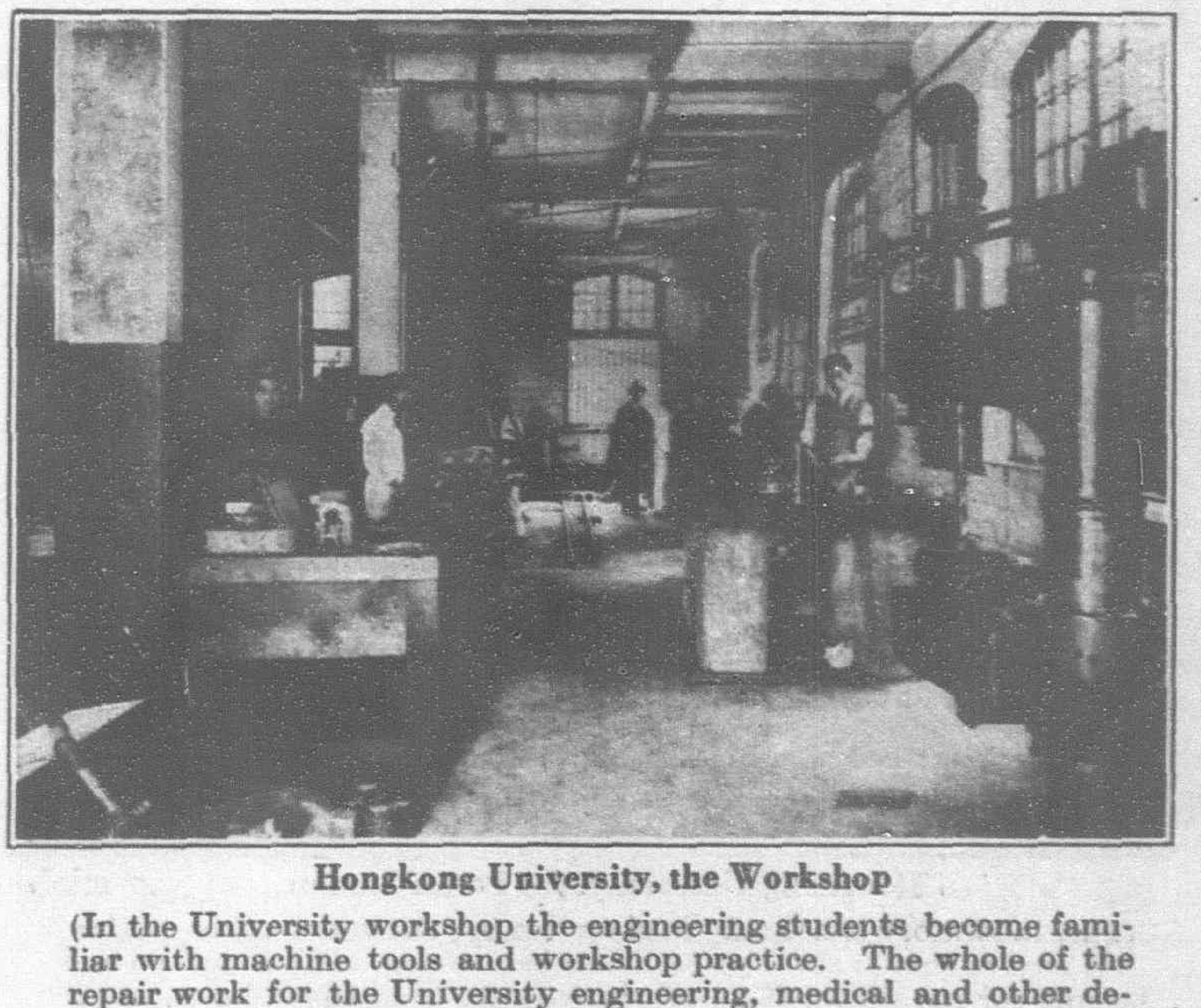
During the last nine years there have been many thousands of visitors to the university. They usually find great interest in the scientific equipment and the machinery which is at work.

The first engineering building visited is generally the electrical power station. This is a separate building adjacent to the main university building. It is about 60-ft. by 60-ft. It contains numerous gas and oil engines many of which are used for the supply of electric light and power and all of which are used by the students for testing purposes.

The equipment in this building consists of (1) 35 B.H.P. Campbell gas engine with suction producer coupled direct to a 20 K.W. G.E.C. (London) dynamo; (2) a 15 B.H.P. Crossley gas engine using either town or suction gas, coupled direct to an 8 K.W. Lancashire Dynamo Motor Co. dynamo; (3) a 10 B.H.P. two cylinder Gardner oil engine coupled to a dynamo; (4) an 8 B.H.P. Campbell semi-diesel oil engine coupled by chain to a 7 K.W. dynamo; (5) a 15 B.H.P. Campbell vertical oil engine driving a 7.5 K.W.D. dynamo; (6) a 25 B.H.P. Daimlet silent knight petrol engine; (7) a 7½ B.H.P. Thornycroft marine motor; (8) a 7 8 B.H.P. Ruston Proctor portable oil engine; (9) a 9 B.H.P. Westinghouse cross oil engine driving a Reavell air compressor; (10) a 4 B.H.P. Turner paraffin engine coupled to a Siemen's dynamo and also fitted for brake tests; (11) a so-light Lister Bruston automatic plant (driven by a petrol engine).

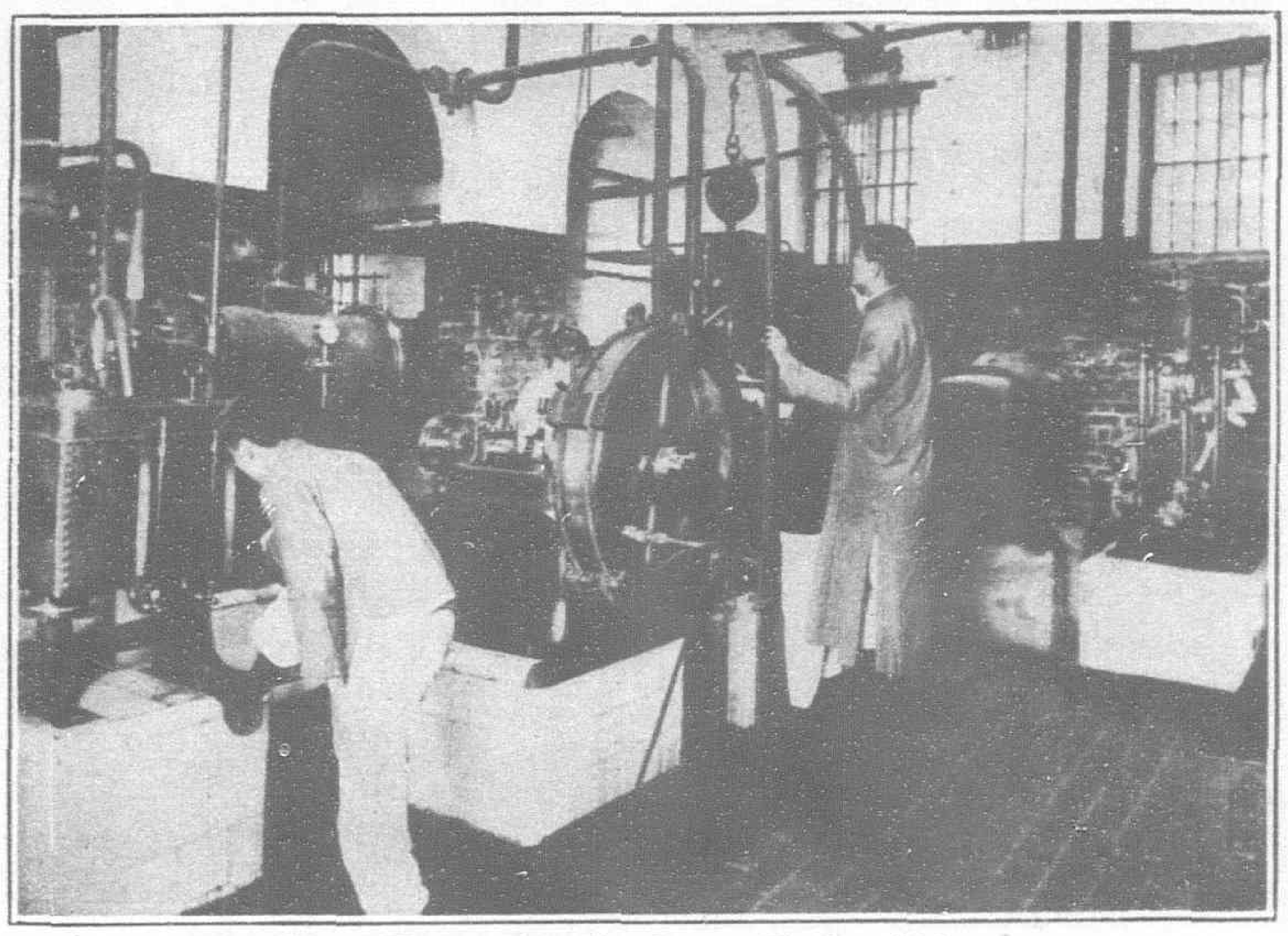
Adjoining the power station is the workshops. The machine and fitting shop is 60-ft. by 30-ft. It contains a motor-driven craven planing machine; a motor-driven Hulse shaping machine; a motor-driven Archdale radial drilling machine; a motor-driven combine tool and dry grinding machine and a 3½-in. motor-driven Drummond lathe, a 6-in. Lang lathe, a 5-in. Buck and Hickman lathe, a Dickinson lathe, a 5-in. Spencer lathe, a Ward capstan lathe, a Milne lathe, a Kendoll and Gent screwing machine, a 10-in. Selson shaping machine, a Jones and Shipmon high-speed drilling machine, a Brown and Ward light drilling machine, a Holbrook & Sons bench-drilling machine, an Alfred Herbert twist drill grinder, an E. & G. Herbert hacksaw, a Wicksteed mechanical saw as well as the usual tools and a complete set of micrometers, gauges, etc.

The equipment for steam and hydraulics is housed in a building adjacent to the power station, although on a lower level. This building was originally used by the government as a pumping station and has been adapted to its present purposes although it is hoped that at no distant date a new building will be erected for steam and hydraulics. The plant now installed consists of (*a*) two water-tube boilers (one is a Babcock and Wilcox boiler with superheater); (*b*) a Marshall steam engine with condenser; (*c*) a compound steam launch engine; (*d*) a motor Belliss air compressor; (*e*) a smaller Broom and Wade compressor; (*f*) a Pelton wheel coupled to a 2 K.W. dynamo and also fitted with a water cooled pulley for brake tests; (*g*) a mixed flow turbine of Francis type, fitted with water cooled pulley for brake tests. Two belt-driven centrifugal pumps supply water to it under heads up to 50-ft.; (*h*) a Drysdale centrifugal pump, direct coupled to a D.C. motor, which has been fitted with a brake pulley for preliminary B.H.P. Test; (*i*) "Venturi" meter, fitted to 3-in. pipe capable of recording up to 160 gallons per minute; (*j*) a vertical tank, fitted with gauger glass and carrying on one side a variety of interchangeable orifice plates; (*k*) a large circular tank with central orifice, for showing the form and action of the free spiral vortex; (*l*) a whirling table, driven by a rope



Hongkong University, the Workshop
(In the University workshop the engineering students become familiar with machine tools and workshop practice. The whole of the repair work for the University engineering, medical and other departments and also for the residential quarters is carried out in the workshops)

from the brake pulley of the Pelton wheel, and carrying a glass cylinder in which the form of action of the forced vortex can be studied; (*m*) a set of iron, brass and glass tubes, for experiment on critical velocities and viscons and turbulent flow; (*n*) a Barker's mill with 4 orifices, working under a head of 3-ft; (*o*) an outward-flow reaction turbine of simple form, working under a head of 3-ft.; (*p*) apparatus for experiments on disc friction; (*q*) a mechanical model of a trochoidal wave and (*r*) apparatus for experiment on the impact of jets upon plane and recurved vanes.



Hongkong University, the Steam Engine Laboratory

(Engineering students are here seen testing a small steam engine. This practical work is a feature of their training)

Mention should be made of the fact that, by the courtesy of the public works department of the colony, the engineering students are able to conduct tests on two large triple-expansion pumping engines and cylindrical boilers used at a neighboring government pumping station.

In connection with the prime movers work there are two ice machines one CO^2 and the other NH^3 each of about 300-lb. of ice capacity. These are tested by the students in the usual manner.

There is also a model paper-making plant which causes great interest and was especially designed, built and presented by Messrs. Bertrams, Ltd., of Edinburgh. Paper from rice straw, rags and other materials has been made with this machine.

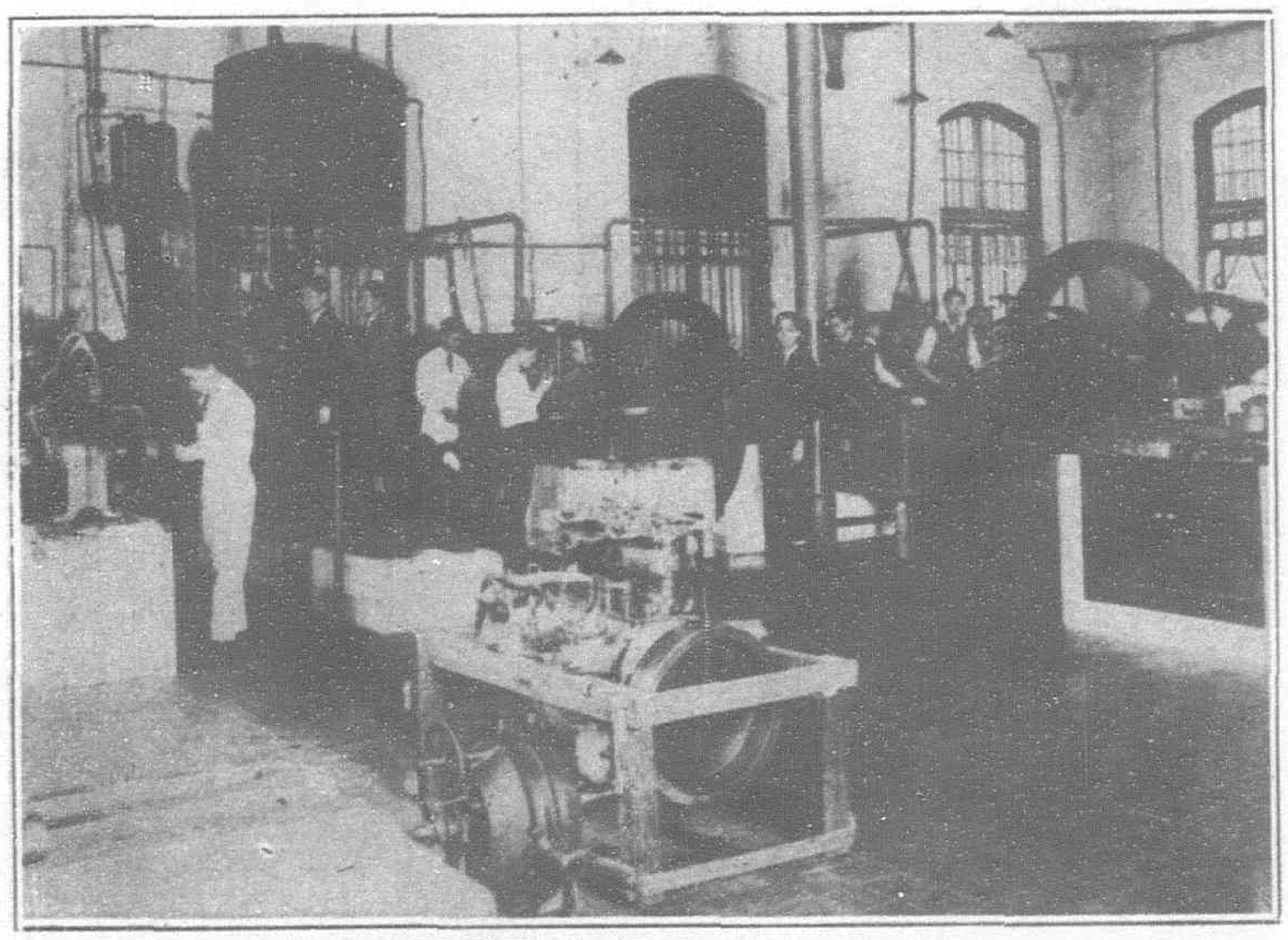
There are a number of models of turbines, engine machine parts in this room containing the paper-making machine.

Adjacent to this room is the junior drawing office where the engineering students of the first and second year receive instruction in geometrical and machine drawing. This is always open and students may often be seen there at work in the evening at their own initiative.

The electrical laboratories consist of (1) electrical machinery laboratory; (2) electrical technical laboratory; (3) photometric room.

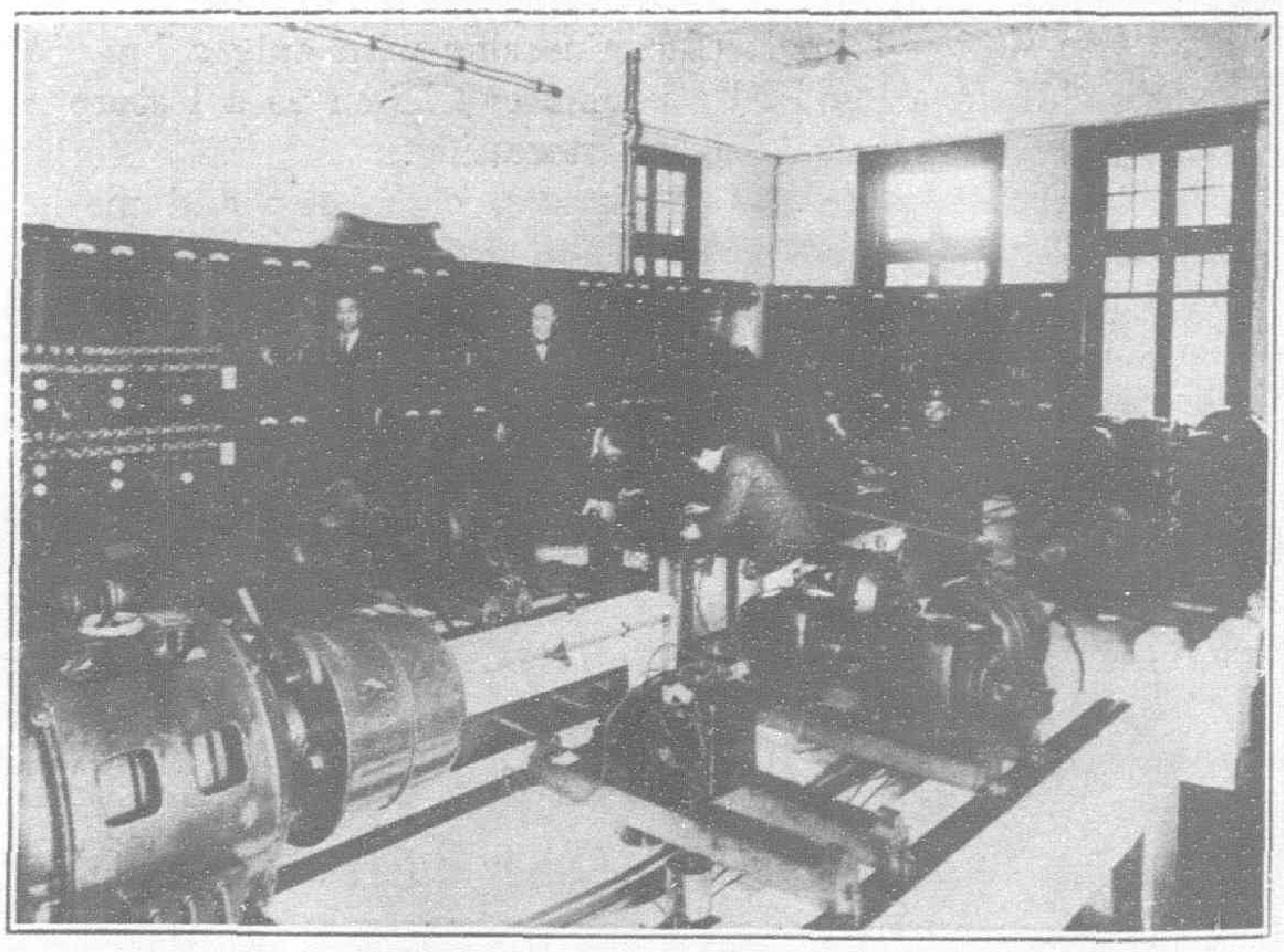
The electrical machinery laboratory is adjacent to the power station and occupies a floor space of 41-ft. by 29-ft.

The equipment consists of (1) Vickers Balareer set consisting of two 110 volt 4 pole shunt wound machines of 7 K.W. capacity each; (2) Vickers motor generator set consisting of (*a*) 110 volts 4 poles shunt motor of $13\frac{1}{2}$ H.P.; (*b*) 220 volt three wire generator of 9 K.W. capacity with static balancer; (3) B.T.H. rotary converter with exciter; D.C. Voltage 220, AC 2 or 3-phase at 50 cycles capacity 7 K.W.; (4) E.C.C. D.C. compound generator, 2 poles, 110 volts, 8.5 K.W. capacity; (5) motor generator set consisting of (*a*) 10 H.P. 110 volt, 50-cycle Bruce Peebles 3-phase induction motor coupled to (*b*) Mawdsley 110 volt 2 pole shunt wound D.C. generator of 10 K.W. capacity; (6) motor generator set consisting of (*a*) 10 H.P. 110 volt, 50 cycle Mather and Platt 3-phase induction motor coupled to (*b*) Mather and Platt 110 volt 4 pole shunt wound D.C. generator, fitted with interpoles and of 7 K.W. capacity; (7) a Vicker's shunt motor 110 volts, 5 H.P.; (8) Brush 3-phase 50-cycle induction motor 5 H.P.; (9) Crypto single-phase 75-cycle induction motor 5 H.P.; (10) Mather and Platt 2-phase 50-cycle induction motor; (11) Brook single-phase 50-cycle induction motor 3 H.P.; (12) Crypto single-phase 75-cycle repulsion motor, 3 H.P.; (13) Mawdsley 480 volt D.C. shunt motor 3 H.P.; (14) Mather and Platt booster, 90 amps, 0-50 volts.; (15) Rhodes A.C. motor, repulsion-induction type 1 H.P.; (16) B.T.H. 110 volts shunt motor 1 H.P.; (17) B.T.H. 110 volts series motor 1 H.P.; (18) crypto motor generator set consisting of (*a*) 110 volt 75-cycle single-phase induction motor driving (*b*) 30 volt 10 amp. D. C. generator; (19) static transformers of various ratios and capacities.



Hongkong University, the Power Station

(This laboratory is not only used for testing the various heat engine but heat engine is also the electrical generating station for power supply for the University. Every evening, from about 6 p.m. to 11 p.m., four or five engines are at work and day and night there is always one or more prime movers supplying power)



Hongkong University, the Electrical Machinery Laboratory

(In this laboratory the engineering students make tests on the various direct and alternating current machines)

The machines are connected to a 22 panel experimental switch board, fitted with starters, rheostat, etc., and two pairs of bustars, main and experimental, arranged so that current can be taken from the power station feeders.

The electrical technology laboratory is in the basement of the university and occupies a floor space of 38-ft. by 29-ft. It is equipped for experiments which need comparatively small currents and it is used by the third year engineering students.

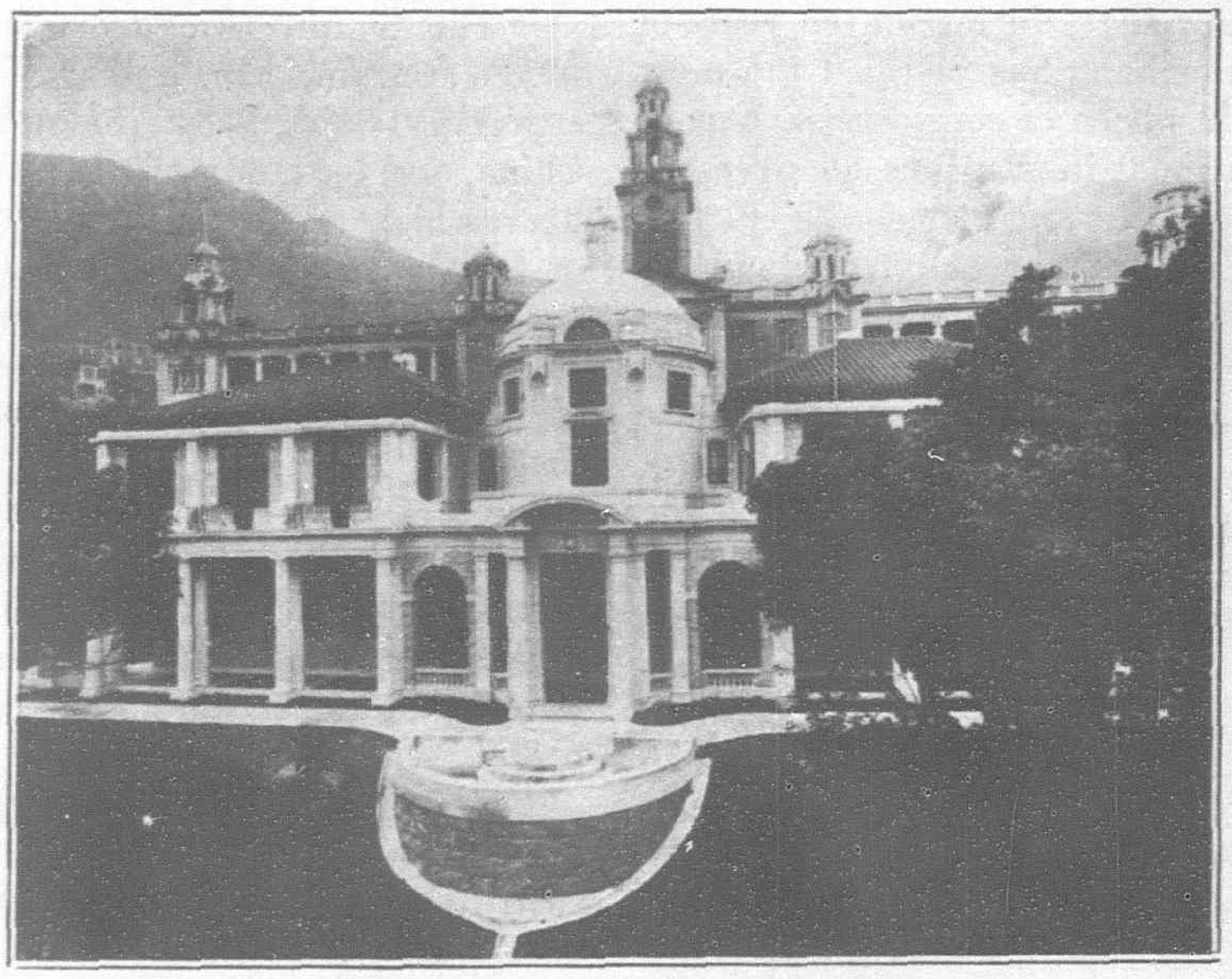
In this basement is a full-size tramcar presented by Messrs. Dick, Kerr & Co., Ltd., with motors, controllers, etc., complete.

The rest of the basement—which is airy and well lighted—is devoted to strength of materials and applied mechanics.

The strength of materials laboratory is fully equipped for the scientific investigation of the phenomena of elasticity and for commercial testing of material of construction. The laboratory occupied 2 rooms, the smaller being devoted to the elementary experimental work and to extensometer measurement.

The larger room contains: (1) A 30-ton Buckton testing machine operated by a Vicker's motor. The controller of this motor allows the straining screw to be operated at any speed within the practical limits; (2) an Avery torsion machine, land operated of maximum capacity of 10,000-inch lbs.; (3) a 1,000-lb. Denison wire testing machine.

The other machine room contains: (1) A 4-ton Avery testing machine; (2) a Bailey cement tester; (3) an Avery cement tester; (4) a Sankey metal bending tester; (5) an alternating stress machine (torsion); (6) a 1-ton testing machine by the Cambridge Scientific Instrument Co. for use with the Ewing extensometer; (7) a 1-ton testing machine by Messrs. Pye for use with the Granter extensometer; (8) apparatus for the study of the flexure of beams; (9) microphotographic apparatus for study of the structure of material.



Hongkong University, Students' Union Buildings

(This building contains reading rooms, a debating hall, billiard room and a refreshment room and is available for all the University students for recreation purposes)

The applied mechanics laboratory is well equipped with apparatus for about 20 experiments.

The senior drawing office is on the top floor of the university and is a room of area 40-ft. by 30-ft. It is used by the third and fourth year students.

Mention should be made of the physics and chemistry laboratories which are airy and well equipped. They are used by the first and second year engineers.

A valuable portion of the student's training is the visits to works, which take place at regular intervals.

Social Life

There is a most active university engineering society which arranges these visits and meetings at which local engineers, visitors and others give addresses of a technical nature.

The students' union building is probably one of the most beautiful buildings in the Far East. It stands on an area of 122 by 42 and consists mainly of four rooms and an entrance loggies. The four rooms are billiard room, a lounge, and they are all beautifully furnished. Concerts are also held in the great hall and the social life of the students at the university is carefully planned so as to provide them with reasonable recreations.

There is a fair sized athletic ground behind the main building of the university of area 100-ft. by 120-ft. The large recreation ground within about ten minutes of the university is of area sufficient for cricket matches. It is distant about a quarter of a mile from the main building on a most beautiful site.

The importance of a healthy social and athletic life for the student is fully recognized by the university authorities. That is one of the chief reasons for having all the students in residence in the university hostels.

There are five "halls or hostels" in which students live. They are respectively named, Lugard, Eliot, May, Morrison and St. John's Hall, and are all attached to or in the grounds of the university.

The area of the grounds (including buildings) of the university is about 1,000,000, sq. ft. The site is on a hill-side, and varies in level from about 200-ft. above sea level to about 450-ft.

Past Records

It should be explained that, in order that there should be no question as to the standard of the engineering degree, the work of these students has been sent to assessors in London who are examiners of the University of London and these assessors have always certified that the standard reached by the candidates from Hongkong has been equivalent to that required for a corresponding degree of the University of London. The following are engineering graduates who obtained honours degrees in engineering in the university:—

First Class Honours: Fu Ping-sheung (1916); Liu Chen-hua (1918); Chien Hung-van (1919); Sung Zau-yoen (1920); Chun Wing-ching (1920).

Second Class Honours: Tang Ying-lam (1916); Leung Nai-hang (1916); Iu Tak-cheung (1917); Lai Hau-chin (1917); Lee Iu-cheong (1917); John Moraes (1917); Wong Zung-kwei (1918); Wong Zung-yu (1918); Shih Ying-ching (1918); Lim Bang-in (1918); Lee Boon-hock (1918); Cheah Sin-bee (1918); Yao Kwang-yu (1918); Hu Kwok-leung (1919); Chau Iu-nin (1920); Lui Sun-lu (1920); Yang Ssu-chien (1921) and Chiu Kwan-tze (1921).

Concerning the employment of these engineering graduates we understand that as close a record has been kept as is possible. A number have gone abroad in order to obtain further practical experience or in order to do post-graduate work. Some are employed on railways, in engineer's and architect's offices, or in commercial organizations; while others have commenced work on their own account.

Constitution

It should be made quite clear that the University of Hongkong is not a government institution, although the university authorities would be first to acknowledge the sympathy and the assistance with the local government has always extended to it. That has been the consistent policy of the Hongkong government towards education almost from the very beginning of the history of the colony in 1841. The governor, as chancellor, is the official head of the university, but the chief executive officer is the vice-chancellor, who devotes his whole service to the administrative work of the university. Sir Charles Eliot, K.C.M.G., LL.D., at present British ambassador at Tokyo, was the first vice-chancellor, and acted in that capacity for nearly six years. His fame as a scholar is too world-wide to need comment. The present vice-chancellor is Sir William Brunyate, K.C.M.G., a distinguished graduate of the University of Cambridge, and for years legal and financial adviser to the government of Egypt. Sir William is now well known in educational circles in China and last year visited Peking, Hankow, Shanghai, Singapore, Penang and Java in order to consult with those interested in education.

The supreme governing body of the university is the court, consisting of about sixty members, many of whom are Chinese and there are also Parsees. There are a number of local *taipans* and prominent commercial men in the colony and in the Far East, generally have identified themselves with the work and well-being of the university. The executive body is the council, which might almost be called a committee of the court. There is a strong finance committee, including, *ex-officio*, the chief manager of the Hongkong and Shanghai Bank.

In academic matters the senate functions and there are boards of faculties to consider matters of special importance to the particular students concerned such as examinations, etc.

There are at present about 260 students, nearly all in residence. There is no reason why the numbers should not increase considerably in the near future if the schools in China can prepare candidates successfully for the entrance examination. As we have already stated, there is room at the university for 500 or more students and, with no very great extensions, the number might easily exceed 1,000 students.

Enough has been written to show that, during its ten years of active service, the University of Hongkong has justified the most sanguine hopes of its founders and has been of considerable benefit to China. In common with educational institutions all over the world it is always able to extend its activities and increase its efficiency if further funds are available. We are, naturally, particularly interested in the development of the engineering faculty and we commend its needs to those who believe that by the development of her vast natural resources China will take her rightful place in the world.

The Vice-Chancellor and Staff

The University has been fortunate in securing the services of a very distinguished scholar and administrator as vice-chancellor and principal. Sir William Edwin Brunyate, M.A., K.C.M.G., has been in the Far East for rather more than a year and has already made many friends in places as far apart as Peking, Hankow, Shanghai and Penang. Before accepting the appointment as chief executive officer of the University of Hongkong, Sir William Brunyate had made a great reputation as a wise counsellor and able administrator in Egypt.

Sir William Brunyate was born in 1867. His University reputation was made in Cambridge University, England, for he graduated under brilliant circumstances. In 1888, he was second wrangler; in 1889, his name appeared in the first division, first class, second part of mathematical tripos and in 1890 he became famous as Smith's prizeman. During the same year, he was the president of the Cambridge Union Debating Society. From 1890-96, he was a fellow of Trinity College, Cambridge, and he was called to the bar at Lincoln's Inn in 1894. He entered the Egyptian government in 1898 and in that service he obtained many honours and acted both as legal advisor and also financial advisor to the Egyptian government. It may be of interest to record that before going to Egypt, Sir William Brunyate acted as professor of mathematics for a year in one of the Australian Universities while the occupant of the chair was on leave. So that, in returning to academic life, Sir William was really going back to work not altogether strange to him.

The first vice-chancellor of the University of Hongkong was Sir Charles Eliot, K.C.M.G., who is now British Ambassador in Tokyo. Sir Charles Eliot was famous for his remarkable academic and diplomatic career. It has often been stated that he is able to converse fluently in twenty-seven languages.

The officers of the University are as follows:

Chancellor: His Excellency Sir Reginald Stubbs, K.C.M.G.
Vice-Chancellor: Sir William Brunyate, K.C.M.G.
Deans: K. H. Digby, M.B., B.S., F.R.C.S. (Faculty of Medicine)
C. A. Middleton Smith, M.SC., M.I. (Mech.) E. (Faculty of Engineering)
W. Brown, B.SC., M.A. (Faculty of Arts)
Registrar: N. Teesdale Mackintosh, M.A. (Oxon)

Modern Scientific Enterprise

It is a very frequent occurrence to hear of some new scientific discovery. Modern medical science advances every day, and in Europe analytical laboratories have been established in order to use these discoveries for the benefit of mankind. In these laboratories some of the world's cleverest scientists are showing what can be done by a practical application of analytical methods.

China is a far cry from Europe, and it would seem that these modern methods are not for her, but a laboratory, fitted with the most up-to-date instruments and apparatus, has been opened at 16 Canton Road, Shanghai, by a man who has made the thorough study of this branch of medical science, his profession.

More and more of late years, has the medical profession been impressed by the fact that a clinical application of this science is not merely worth while, but necessary in modern medicine, and this laboratory, though principally working for and with the profession, does welcome patients for private diagnosis. It ought thus to be of great service to people in the Far East.

The symptoms of most diseases may be found in liquids, e.g., blood, sputum, urine and also in the feces; tests of the last-named especially being very important. Parasitical diseases flourish in China, and for many of these there are no characteristic symptoms upon which to base a clinical diagnosis. Possibly only after years of treatment for dysentery, gastritis, enteritis, etc., may the realization that it is some other disease, force itself upon the sufferer. These parasitical diseases, though often mild in character, sometimes give rise to grave secondary bacterial affections, of which an early diagnosis is imperative. But some parasitical diseases, such as amœbic dysentery, follow a bacterial disorder, and immediate knowledge of the cause of such disease is necessary, in order that a special treatment may be commenced, as there are many forms of dysentery, each of which needs a different remedy. The analytical tests obviate the possibility of mistakes when determining the nature of these diseases.

Take for instance, malaria; in the sub-acute and chronic forms there are no clinical characteristics. Some symptoms, such as enlargement of the spleen, gastro-intestinal disturbances, anæmia, etc., are also common to non-malarial affections, but when the blood analysis is used there is no likelihood of a mistaken diagnosis.

The blood is the most sensitive liquid known, if a foreign element is present in the body, the blood immediately sets up a counteracting ferment. This theory underlies Professor Abderhalden's reactions, which have been latterly improved upon to such an extent, that an analysis of the blood will show with certainty whether any foreign growth is malignant (cancer) or not. Again, in the case of cancer, it seems highly recommendable to have an analysis made a few weeks after the operation, to prove whether it has been possible to remove all of the malignant body, or whether a particle left has started a new growth. The head of the institute is particularly familiar with these tests, having only returned from working with Professor Abderhalden.

From the foregoing it will be seen that familiarity with analytical chemistry is of great importance to modern scientists, and more especially so in the Far East, where diseases such as have been mentioned, are very prevalent, as the analytical method disposes of the possibilities of mistakes when determining the exact nature of various diseases. The establishment of this Bakteriolog.-Serolog. Institut must therefore be regarded with great satisfaction by public of China.

China's Window-Glass Imports

The curve of China's consumption of window glass indicates a growing demand for the substitution of glass for paper windows. The pre-war year of 1913 marked a 50 per cent. increase in consumption over 1912, and had the war not intervened China's present consumption of window glass would no doubt be much greater.

The Superstructure of the Netherlands India State Railways

By H. L. Slinkers, Chief Engineer at the Construction and Bridge Department of the State Rail and Tramways in Netherlands India

1. *Length and Gauge of Lines in Exploitation.*—According to the law of April 6, 1875, the construction of the state railways in Java was started, for which a normal gauge of 1067 m.m. was chosen. Nearly three years later (May 16, 1878) the first line could be opened for public traffic. This was the line Sourabaya-Pasoeroean of a length of 63 K.M. After this, continuously was worked at the extension of the system, and, at the same time, tramways of narrow gauge (600 m.m.) were laid down. Moreover, some lines, not built by the S.R. were taken over, under more tramlines of 750 m.m. gauge, so that in 1920 there were in exploitation:

Java ..	Gauge	1067 m.m.	2510 K.M.
,, ..	,,	600 ,,	119 ,,
South Sumatra	,,	1067 ,,	229 ,,
West ,,	,,	1067 ,,	245 ,,
North ,,	,,	750 ,,	515 ,,
		Total ..	3618 K.M.

In this table is not included the line Solo-Djocja (60 K.M.) which line the S.R. has in common use with the N. I. Railway Company. Last named company is owner of this line, and has constructed it in broad gauge (1435 m.m.) For use by the S.R. a third rail has been added.

Railways and tramways in N. I. exist only on the islands of Java, Sumatra and Madura. In Celebes a state-tramway is in course of construction.

The S.R. have principally single track. At the end of 1919 the total length of double, triple and quadruple track only attained a length of nearly 30 K.M.

However, the doubling of the track is being carried out vigorously at the most important line sections. On the following lines the track will be doubled, a greater part of which is now completed:—

Meester-Cornelis-Tjikampek	72 K.M.
Wonokromo-Krian	21 ,,
Krian-Kertosono	58.5 ,,
Padalarang-Bandoeng	14.5 ,,
Total ..	166. K.M.

2. *Subdivision of the System.* (*a*) *According to Exploitation.*—The government has fixed three "General Regulations" according to which the railways and tramways in N. I. are managed as primary, secondary railways or as tramways. According to this subdivision there are in exploitation:

Primary Railways	Java	1523 K.M.
Secondary ,,	,, ...	752 ,,
Tramways (1067 m.m.)	,, ...	235 ,,
,, (600 m.m.)	,, ...	119 ,,
Secondary railways, W. Sumatra	.. ..	245 ,,
Tramways (1067 m.m.), S. Sumatra	.. ..	229 ,,
,, (750 m.m.), N. Sumatra	.. ..	515 ,,
	Total ..	3618 K.M.

The loading-gauge, fixed by the General Regulations has the same dimensions for secondary railways and tramways of 1067 m.m. gauge, i.e., max. width 3.20 m., max. height above top of rail 3.85 m. For primary railways and narrow gauge tramways another profile has been determined upon. For the prim. railways the max. width is fixed at 3.70 m., max. height at 3.85 m. For tramways of 600 m.m. gauge: max. width 2.70 m., max. height 3.40 m.

Besides the loading-gauge, the prescribed max. speed is characteristic. This max. speed amounts to:

75 K.M. an hour for prim. R.R.
45 ,, ,, ,, ,, sec. ,,
30 ,, ,, ,, ,, tramways.

These speeds, however, have been increased by different revolutions for particular line-sections, with which the max. speeds given in sub 2*b* are connected.

It is intended to make the trip Weltevreden-Cheribon-Kroja-Soerabaya possible in one day (822 K.M.), so that on the level sections of this line (only 57 K.M. is through mountainous country) a speed of 100 K.M./hour may be attained. Until now this speed has been attained only on trial-runs. For the time being the maximum speed is 75 K.M./hour.

(*b*) *According to Speed and Construction.*—In connection with the greatest allowable speed, the S.R. has divided its normal lines in Java into the following sections:—

Section A1	level lines	max. speed	100 K.M./hour	— 689 K.M.
,, A2	,, ,,	,, ,,	75 ,, ,,	— 404 ,,
,, B1	mount. ,,	,, ,,	65 ,, ,,	— 57 ,,
,, B2	level ,,	,, ,,	60 ,, ,,	— 82 ,,
,, B2	mount. ,,	,, ,,	50 ,, ,,	— 198 ,,
,, C	level ,,	,, ,,	50 ,, ,,	— 321 ,,
,, C	mount. ,,	,, ,,	45 ,, ,,	— 524 ,,
,, D	lines	,, ,,	40 ,, ,,	— 235 ,,
			Total ..	2510 K.M.

By this subdivision the construction of the railroad also is fixed.

3. *Largest Locomotives and Axle-loads.*—The largest and heaviest locomotives of the S. R., which at the same time show the greatest axle-load and cause the greatest rail-stresses are: on the level-lines: the 2—C—1: 4 cylinder compound locomotives with four-axle tender. Total weight 106 tons, max. axle-load 12 tons.

On the mountain-lines: the 1—D—D (2—8—8—0) locomotives with four-axle tender. Total weight 133.46 tons, max. axle-load 11.38 tons.

Fig: 1.

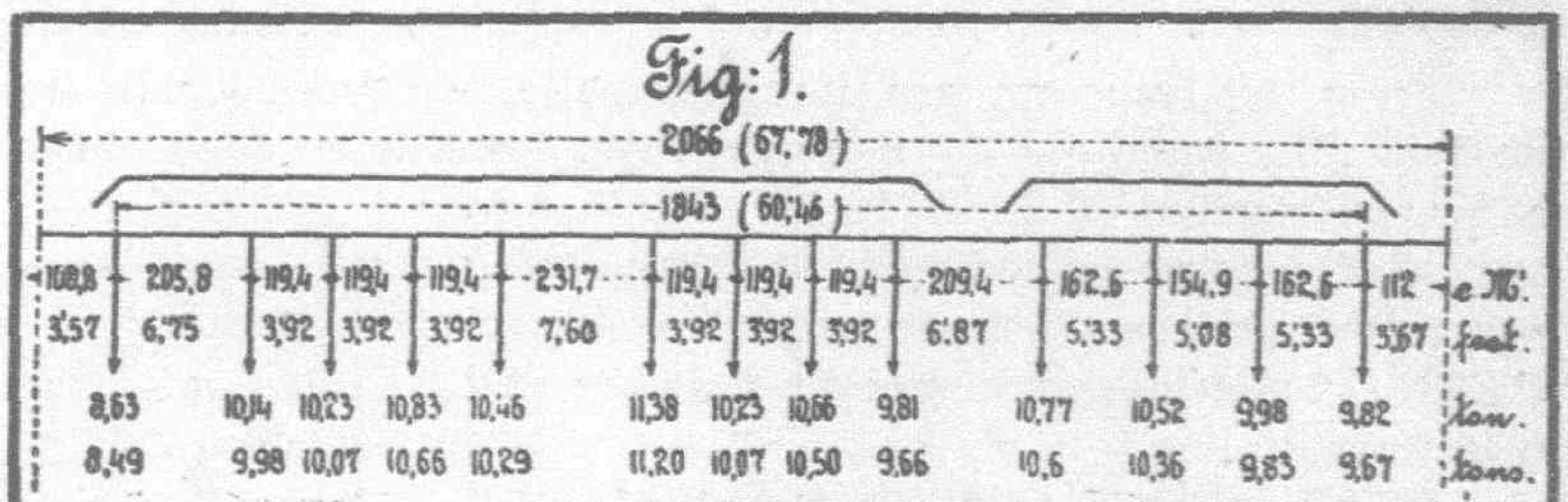

2066 (67.78)
1843 (60.46)
108.8 205.8 119.4 119.4 119.4 231.7 119.4 119.4 119.4 209.4 162.6 154.9 162.6 112 c.M.
3.57 6.75 3.92 3.92 3.92 7.60 3.92 3.92 3.92 6.87 5.33 5.08 5.33 3.67 feet.
8.63 10.14 10.23 10.83 10.46 11.38 10.23 10.66 9.81 10.77 10.52 9.98 9.82 ton.
8.49 9.98 10.07 10.66 10.29 11.20 10.07 10.50 9.66 10.6 10.36 9.83 9.67 tons.

Fig: 2.

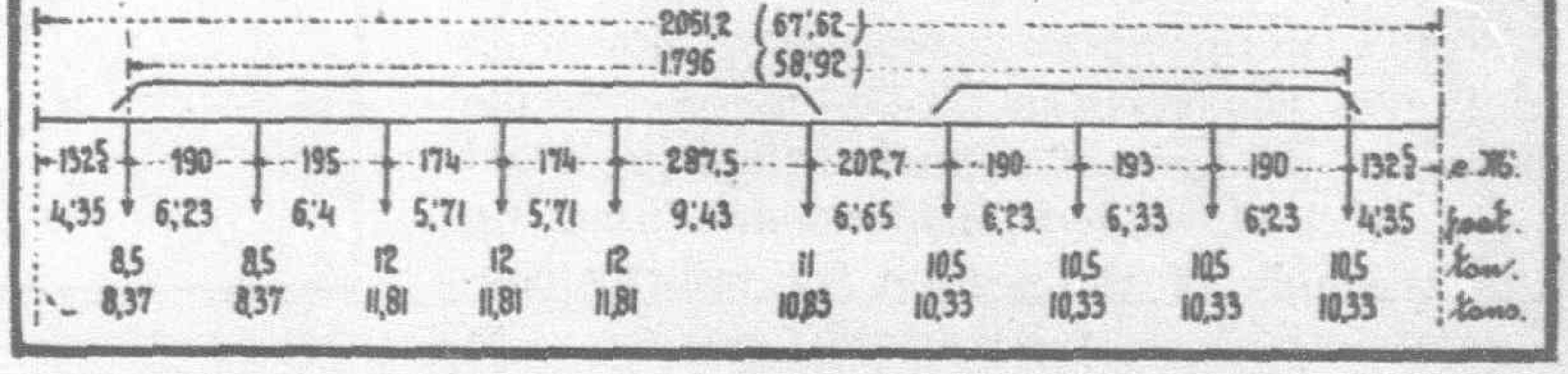
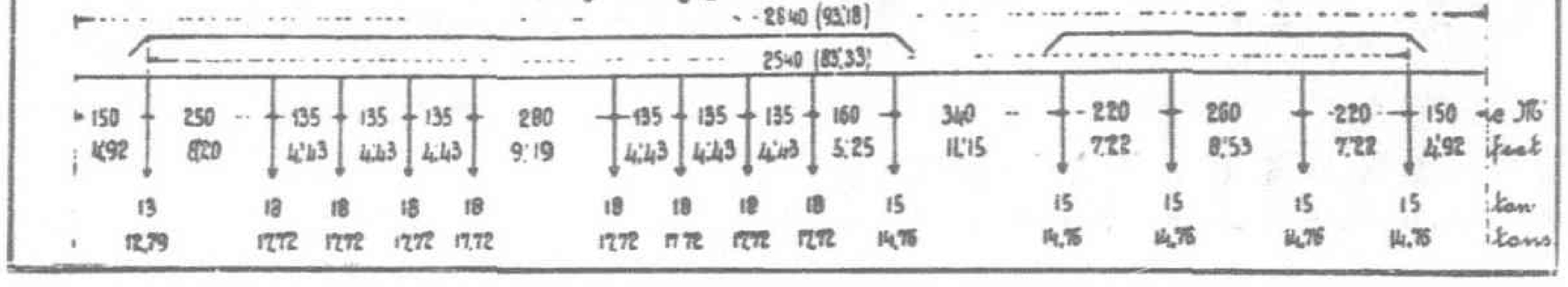

2051.2 (67.62)
1796 (58.92)
132.5 190 195 174 174 287.5 202.7 190 193 190 132.5 c.M.
4.35 6.23 6.4 5.71 5.71 9.43 6.65 6.23 6.33 6.23 4.35 feet.
8.5 8.5 12 12 12 11 10.5 10.5 10.5 10.5 ton.
8.37 8.37 11.81 11.81 11.81 10.83 10.33 10.33 10.33 10.33 tons.

Fig: 3.

Denkbeeldig toekomstig schema } 1 D + D 1
Imaginary future scheme }



Construction of Superstructure

4. *General Remarks.*—Dr. J. A. H. Haarman, chief engineer of the department of construction and bridges of the S. R., has had an important share in the construction of the superstructure. By him, in 1908, the track of 1067 m.m. was submitted to a calculation, the results of which have been compared with the 1435 m.m. gauge, used in Europe.

Two studies were published by him, viz. :

(*a*) " Beschouwingen over den bovenbouw van het spoor met wijdte van 1067 m.m., in het bijzonder van dat der Staatsspoorwegen op Java." Ed. of the Javasche Boekh. en Drukkerji, Batavia 1908.

(*b*) " Raillasschen, Ene aanvulling der berekeningswijze van Dr. H. Zimmermann en een pleidooi voor de lasch met uitkragende steunlaschplaten." Ed. as *a*.

In consequence of the study sub *a*, based on the theory of Zimmermann, the construction of the track with the rail No. 2 (weight 25·75 K.G./M.) as introduced in 1900, was abandoned, as being less suitable, and in 1909 was proceeded to use rail No. 3 (weight 33·4 K.G./M.), with joint-construction and sleeper-space as mentioned in the work of Mr. Haarman and further described sub. 14.

In the study sub *b* quite new views were given about the effect of long fish-plates. The use of long fish-plates not always appears to secure smooth running, and therefore a new system has been recommended, about which more will be said sub. 14.

Now we proceed to more detailed description of the track.

The Rails

5. *Types of Rail of the S.R.*—The following types of rail are used by the S.R. on the through lines :—

Weight K.G./M.	Information	Location		Length K.M.
40.05	Tunnel near S. Loento	West Sumatra		0.8
33.4	Rail No. 3	Java		972.0
27.02	,, 1	Java (Bangil-Malang)		49.0
25.75	,, 2	Java	1418.0	
,,	,, 2	S. Sumatra (Lampong line)	77.0	
,,	,, 2	W. Sumatra	244.2	
,,	,, 2	N. Sumatra (Atjeh)	43.5	
			———	1782.7
25.75 à 29.76	Partly rail No. 2	S. Sumatra (Palembang line)		152.0
25.4	Iron rail	N. Sumatra (Atjeh)		4.5
20.8 à 21.1		Java (Babat-Djombang)		71.0
16.4	Gauge 750 m.m.	N. Sumatra (Atjeh)		467.0
11.2 à 14.88	,, 600 m.m.	Java		119.0
			Total...	3618.0

From this table appears that principally two types of rails are used, i.e., No. 2 and No. 3. In March, 1919, it was determined to use a heavier section of 45 to 46 K.G./M. and to use this type, i.a., on sections, where replacing rail No. 2 by a heavier one will be necessary. Rail No. 2 continues for section railways and tramways.

It still forms a point of consideration, if for the new railsection will be chosen the Prussian profile No. 15 or the Dutch normal profile No. 46. In this question the cost of procuring will give the decision. Last named profile belongs to the series of normal sections projected by a Netherl. rail-commission, and fixed in the assembly of the section for railway construction and exploitation of the institute of (Dutch) engineers held on Oct. 18, 1916. The principal dimensions of both profiles, with those of Nos. 2 and 3, will be found in next table; further the profiles Nos. 2, 3 and NP 46 are represented in Figs. 4, 5 and 6.

Definition	Rail No. 2	Rail No. 3	Prussian No. 15	Dutch NP 46
Weight in K.G./M.	25.75	33.4	45.05	46.23
Height m.m.	110.—	134.—	144.—	142.—
Width of base m.m.	90.—	105.—	110.—	120.—
Width of top m.m.	53.—	58.—	72.—	72.—
Tickness of web m.m.	10.—	11.—	14.—	14.—
Max. moment of inertia in c.m.^{4} ...	538.3	1036.6	1582.9	1640.—
Min. moment of inertia in c.m.^{4} ...	88.9	150.7	259.1	310.—
Max. moment of resistance c.m.^{3} ...	97.4	154.0	216.8	231.—
Min. moment of resistance c.m.^{3} ...	19.8	28.7	47.1	51.67

6. *The Elevation of the Outer Rail in Curves.* (*a*) *For the Sections A_2—B_2—C and D.*—This is fixed by the well-known formula:

$$h = \frac{V^2\ s.}{R.\ g.} \text{ where:}$$

h=elevation in m., s=distance c. t. c. of railtop=nearly the gauge in m.

V=speed in m./sec., R=radius of curve in m., g=accel. of gravitation in m./sec.

However, in view of the slower trains, for V not the max. speed of the section is taken, but a smaller one. By various considerations in connection with the number and speed of trains, for V are taken the speeds of 14—12—10 and 8 M. per sec. for the above-named track-sections. It appears that the elevations thus arrived at, are about half of what should be obtained, when for V had been taken the max. speed of the section.

Elevations less than 0.02 metre are not practised.

b. For the Sections A^1.—In view of the great speed (100 K.M./hr) which on these sections will be applied, another method of calculation has been followed. Departed was from the greatest speed admitted in curves on the European gauge of 1435 m.m. This speed is considered to be allowable on the gauge of 1067 m.m.

R. in Metres	900 and more	800	700	600	500	400	300
Max. speed in K.M./hour	100	95	90	85	80	75	56
Max. speed in M./sec.	27.8	26.4	25.0	23.6	22.3	20.9	18.1

This table is taken from the Eisenbahn-Bau und Betriebs-Ordnung of the German empire, although without increasing the speed to more than 100 K.M.

Putting in the above-mentioned speed for V, the elevation of the outer rail is fixed by the formula :

$$h = \frac{V^2\ s.}{R.\ g.} = 0{\cdot}03$$

in which formula the letters have the meaning already mentioned. The line of thought has been the following :—

Taking into account the slow trains, the amount should be fixed with which the theoretical elevation, necessary for the max. speed, should be diminished. From tests taken by Bräuning* it appeared that the theoretically necessary elevation may be diminished or increased by 1/50 to 1/20 of the gauge, without causing trouble to passengers.

Fig:4.

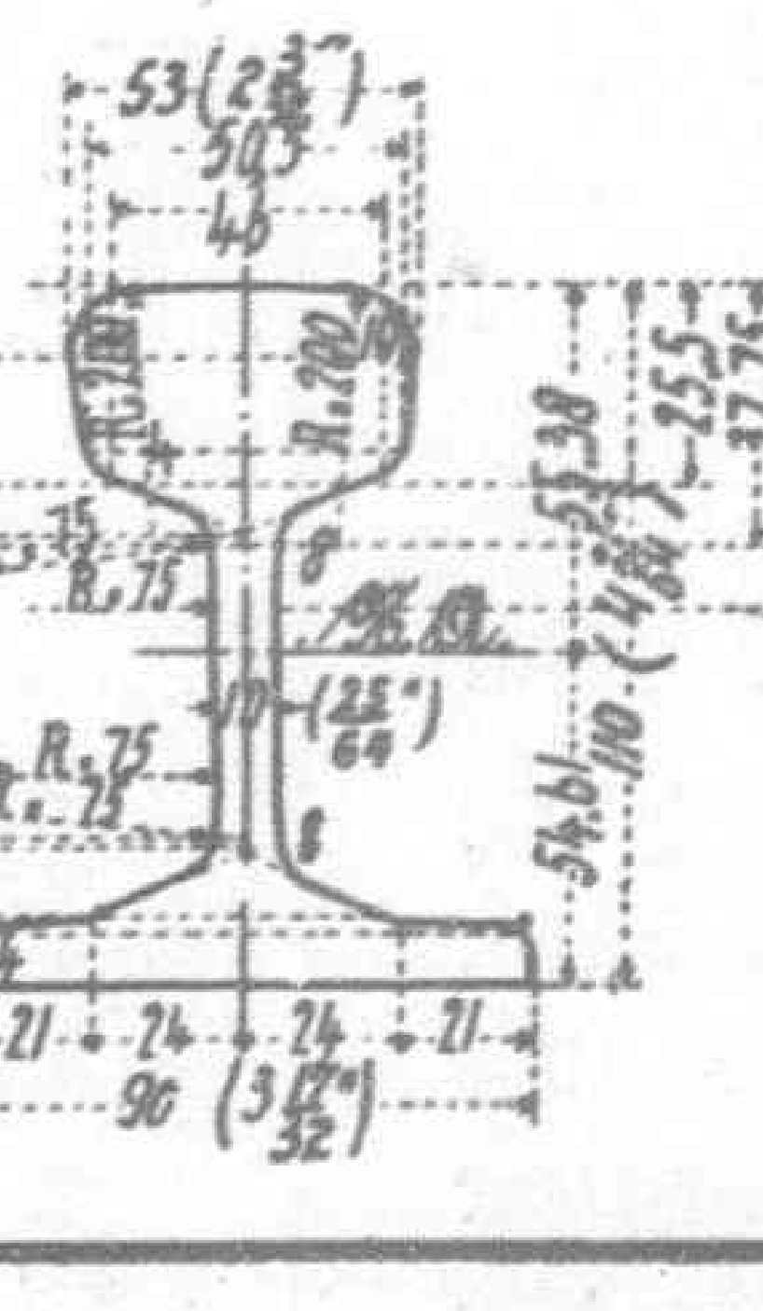


Fig:5.

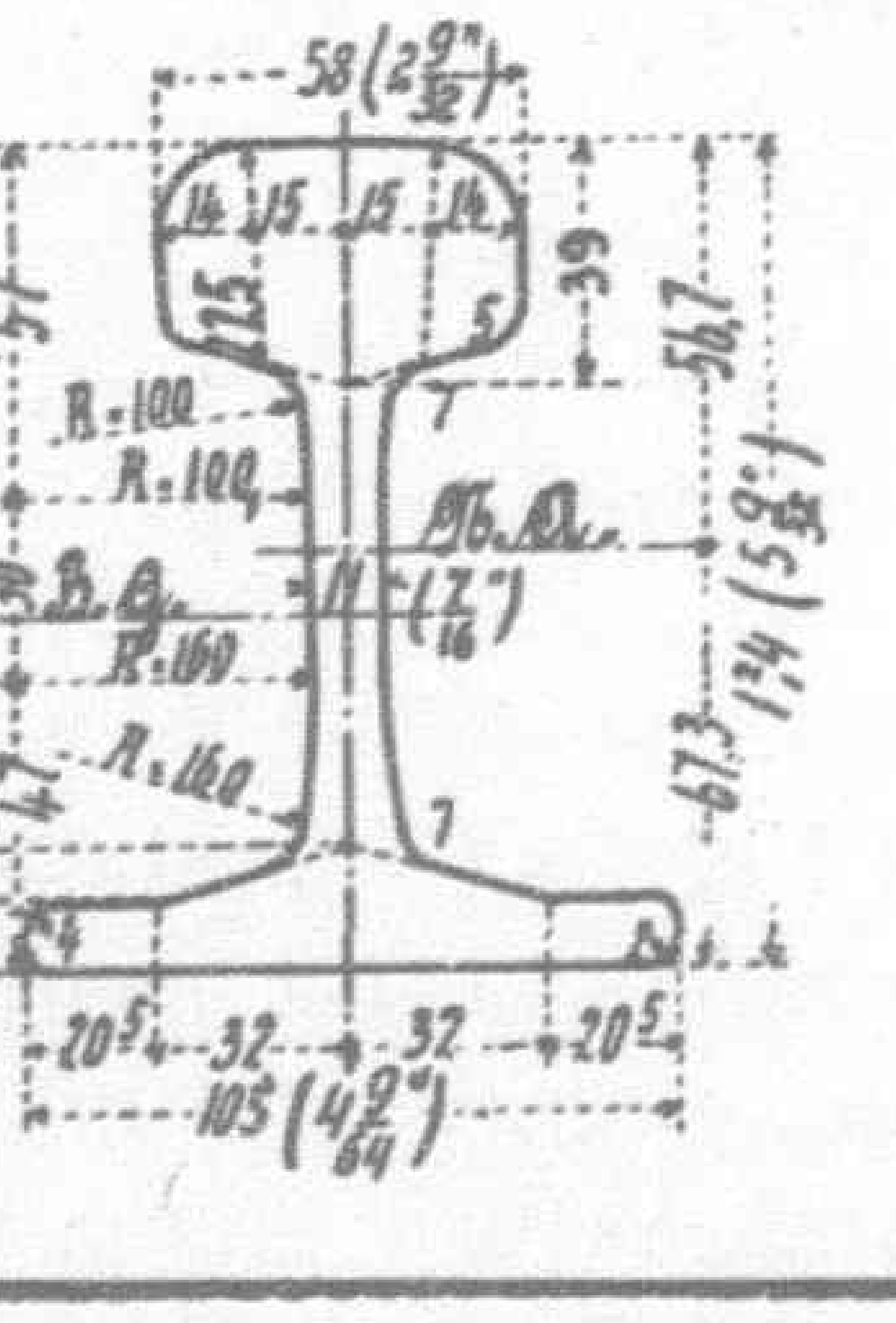
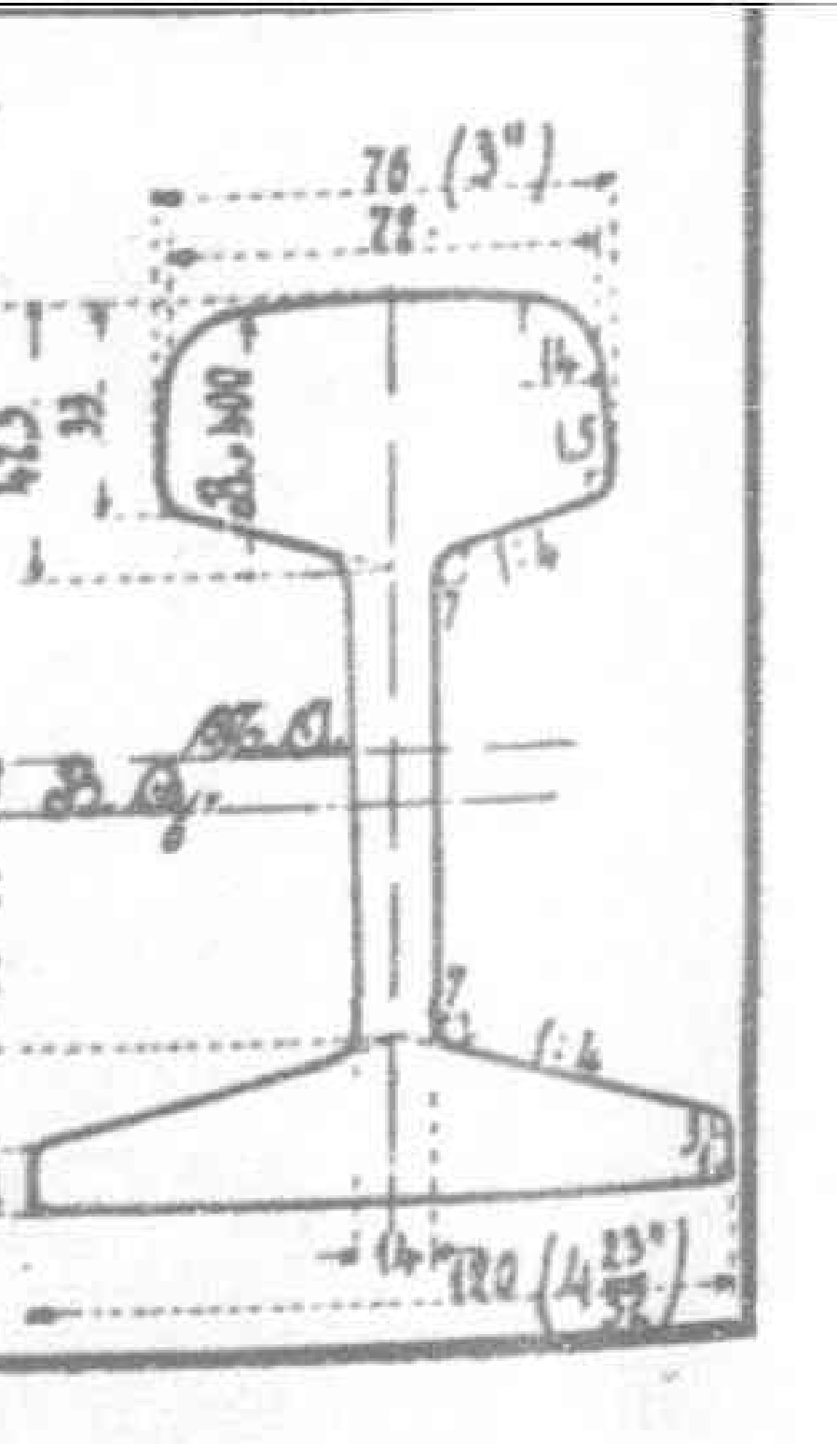


Fig:6.



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* See Handbuch der Ingenieurs. Wissenschaften," page 139, second Edition, 5th part, 1st vol.

This is equivalent to 1067/50 to 1067/20 or nearly 0·02 to 0·05 m. An average of 0·03 was then chosen. Thus, after rounding off to 5 m.m. the next table was got at, wherein for R=2000 and 3000 m. also the smallest elevation of 20 m.m. was applied.

R in Metres	3000	2000	1500	1200	1000	900	800	700	600	500	400	300
Elev. h in m.m.	20	20	25	40	55	60	65	65	70	80	90	908

c. For the Sections B^1.—For the sections B^1 the same elevations are used in curves of the same radius as calculated for A^1.

7. *The Transition-curves.*—The transition-curves have the shape of the generally used cubic parabola, according to the formula

$$y = \frac{x^3}{\text{constant}}$$

For the sections A^2—B^2—C and D the constant has for all curves the following values respectively 76824—56442—39196 and 16742 :—

For the sections A^1 the constant=6000 Rh.
,, ,, ,, B^1 ,, ,, =3600 Rh.

8. *The Increase of Gauge in Curves.*—The increase of gauge in curves of 150—200—250—300 and 400 m. radius respectively amounts to 20—15—10—5 and 5 m.m. In curves of 500 m. radius and more, no increase is applied.

9. *Rails on Bridges and Open Water-passages.*—On the bridges the largest distance between sleepers is not more than the max. distance admitted on the section.

At the transition to the bridge, care is taken to decrease the sleeper-distance of the last three sleepers on the abutment to 60 c.m., and is the distance between the last sleeper on the abutment and the first one on the bridge as small as possible (max. 70 c.m.)

At open water-passages, the width of the passage is 70 c.m., so that the distance of the supporting points is larger than the distance of the sleepers on the roadbed. Therefore the rail often is reinforced by a longitudinal wooden sleeper.

10. *Testing Requirements of the Rails.*—The material of the rails is ingot-steel with a tensile strength of 60-70 K.G./m.m^2, and an elongation of resp. 11.5 to 14 per cent. Rails of chrom-nickel steel are not yet in use.

The chemical composition must satisfy the following conditions: Carbon at the utmost 0.55 per cent. sulphur max. 0.06 per cent., and phosphor max. 0.10 per cent.

Further the rail has to satisfy to falling tests, etc., about which nothing more will be said.

11. *Distortion of Rails. (a) By Temperature-variations.*—The change in length is made possible by the clearance between the ends of the rails. This clearance, when not directly exposed to the heat of the sun, should amount to 5—6—7— and 7 m.m. respectively for the normal length of 6·80—10·20—11·90—13·60 metres. The nuts of the fish-bolts are fastened with a washer of a specially fixed length, so as to avoid too intense fastening, and to secure a free expansion in the joint.

The loosening of the nuts is prevented by safety-appliances i.a. by using spring washers between nut and fish-plate, or by using the so-called large nuts, which are not secured (see Fig. 12). These large nuts at the underside are turned concave, so that only the circumference bears on the fish-plate. In this manner a great moment of friction prevents loosening.

b. By Wear of the Rails.—Rails that are used up to a loss in weight of 12 per cent., or to an extent, that in curves, the wheels touch the fish-plates of the outer rail, are replaced.

c. By Over-loading.—On some sections, f.i. on the line Poerwakarta-Padalarang, where the rail No. 2 is heavily loaded (see sub 12) were observed alternately bright and dark spots. Originally it was thought this was caused by the well-known undulating wear of the rails.

However, after some measurements, it soon became clear that these phenomena was to be explained by over-loading, to which the rails in question were subjected. The rails show a wave-like surface, caused by permanent distortion. The lower points occur nearly in the middle between two sleepers, the higher ones not quite above the sleepers, but somewhat besides of these. The observations on this question are still being continued.

The Joints of the Rails

14. *Description of the Different Models.*—The different types are to be distinguished according to the year of prescription.

Fig 8

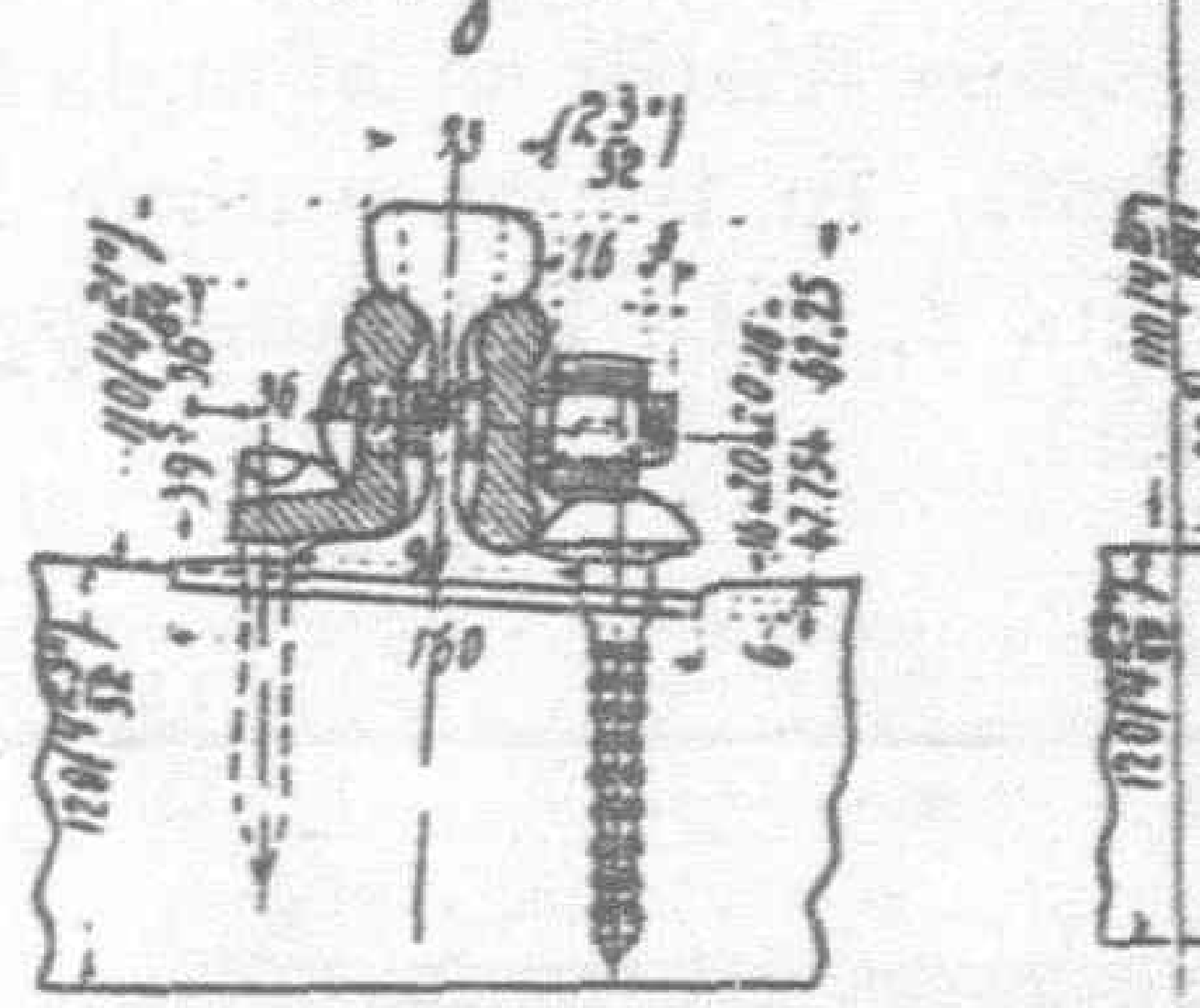


Fig 9

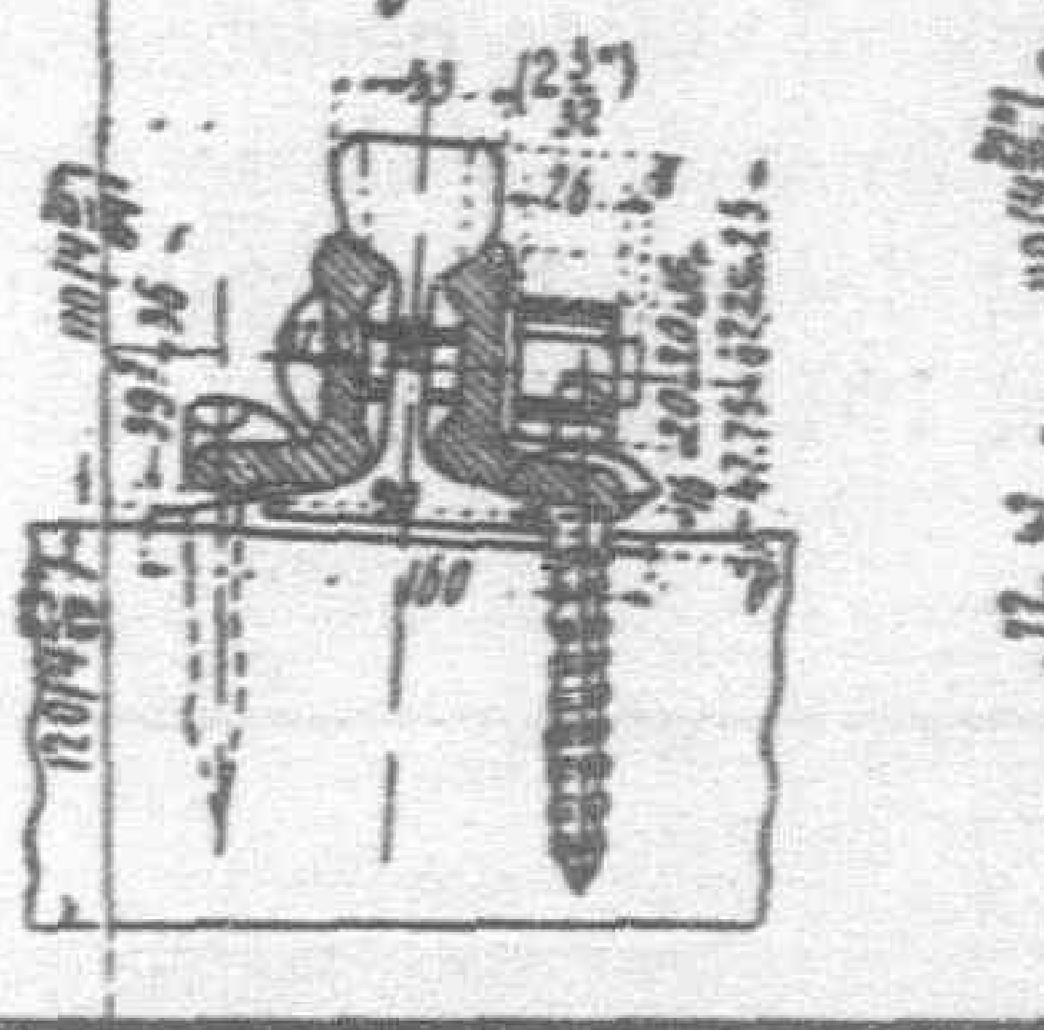
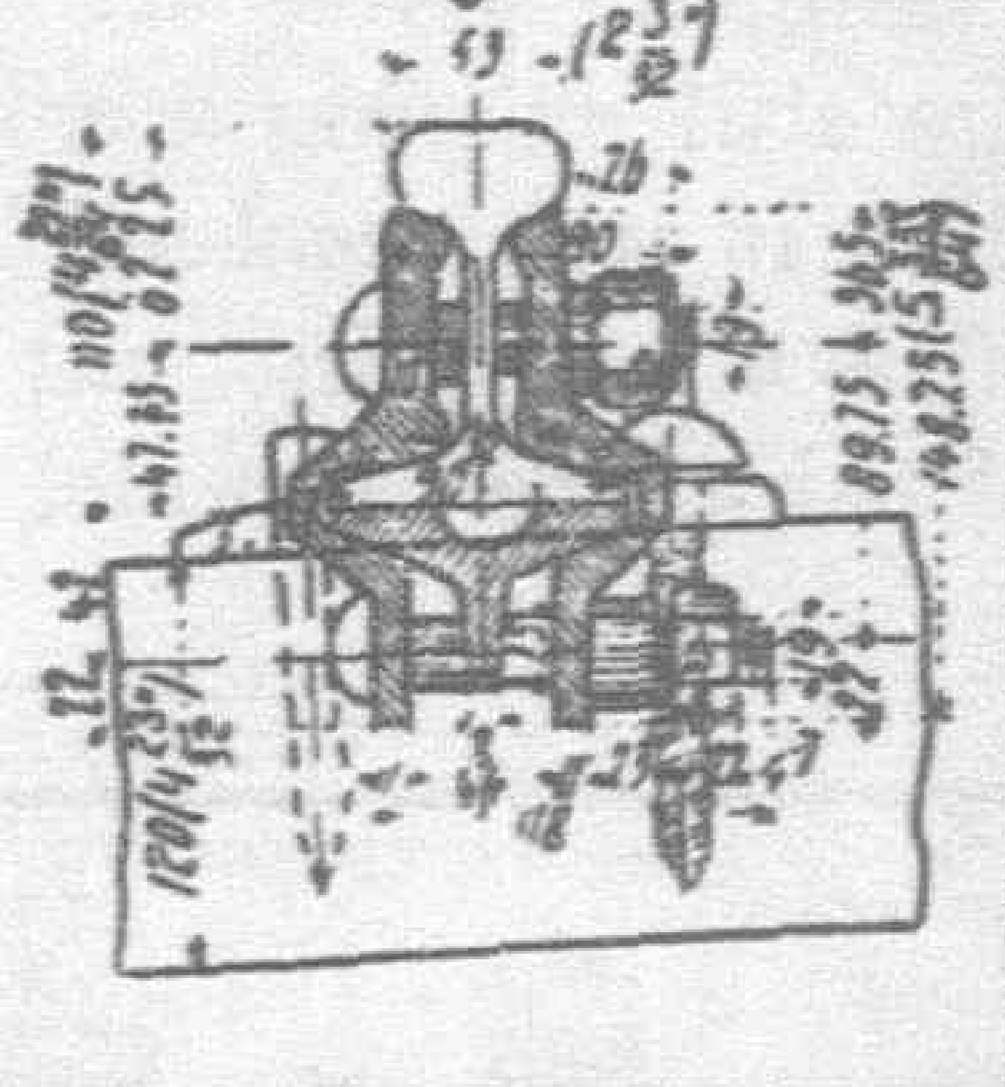


Fig: 10.



Model 1875 (see Fig. 8). The original construction exists of a flat inner- and an angle-formed outer fish-plate. When the traffic increased, the joint construction was found to be too weak, there aroused deflections in the track the so-called cat-backs.

Model 1895 (see Fig. 9). When in 1895 reinforcing the permanent way was thought to be urgent, and the length of the rails was changed from 6.80 to 10.20 metres the joints also were made more solid. For the inner fish-plate also was used an angle-formed one.

Model 1900 (see Fig. 10). Both angle-fish-plates were replaced by wing-fish-plates. Between these two fish-plates, under the foot

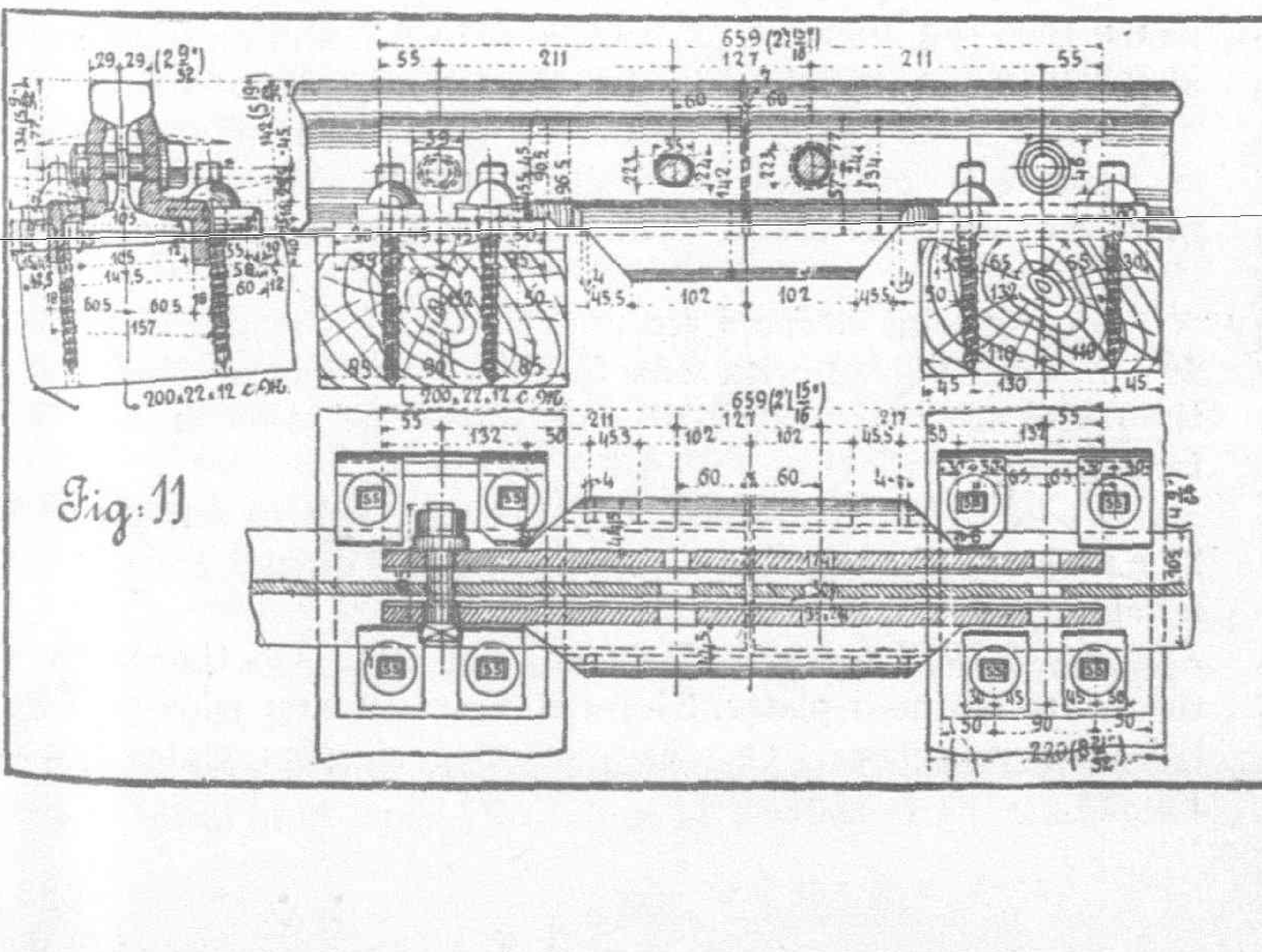


Fig: 11

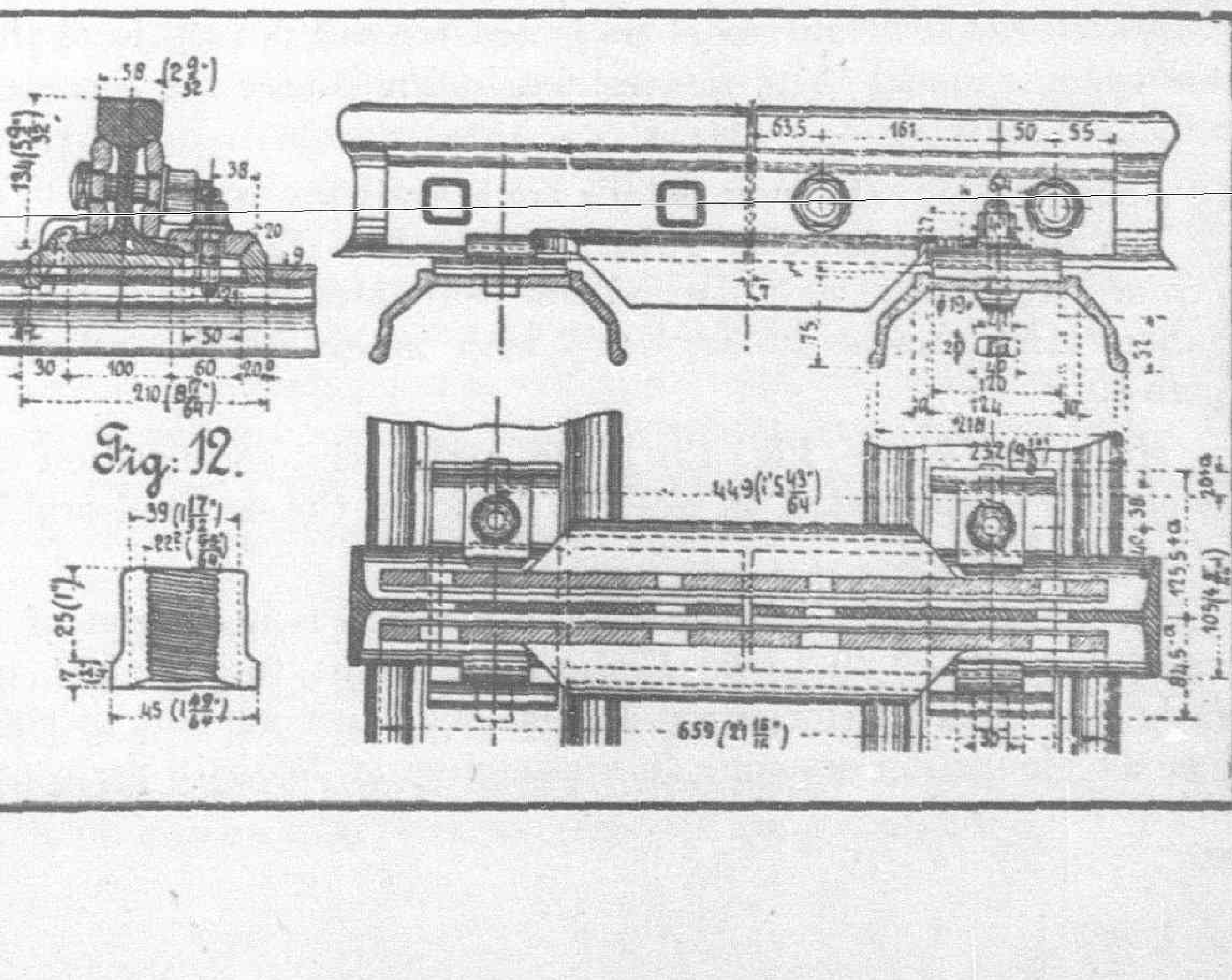


Fig: 12.

of the rail, is fitted a T-piece, jammed by long coupling bolts between the fish-plates. In this manner it was supposed both the head and the foot of the rail-ends should be rigidly fixed, so that the profile of the rail was united as complete as possible. In practice, however, it became clear that the T-piece does not join the bottom of the rail. It, the T-piece, shifts when under charge. Further the tightening up of the bolts under the railfoot has the consequence, that the fish-plates above the railfoot give away to the outside, so that the rail-heads are less sufficiently joined. The wing-fish-plates also have a too complicated shape, so that the true moment of inertia will appear to be much smaller than the theoretical one.

Finally it was observed that the fish-plates cracked at the point where the reinforcing commenced. The passing over from one profile into the other is too sudden.

The joint is still in use, however, without the T-piece and the coupling bolts at the underside.

Model 1909 and 1910 (see Figs. 11 and 12). In 1909 came into use the heavier rail No. 3. A new construction of the superstructure was projected. Model 1909 is used with wooden sleepers, model 1910 with iron ones.

The fish-plates have a much simpler shape. Although in Europe already long fish-plates with 6 bolts were in use, this was not imitated by the designer, Dr. J. A. H. Haarman, for reasons he gave in his work, mentioned sub 4a. Long fish-plates have the disadvantage of causing jumping of the not-loaded rail-end, on which detail will be said more (see sub "Model 1915").

Model 1911. In 1911 also for rail No. 2 a better joint was designed. The fish-plates have the same shape as model 1909. These fish-plates are already ordered, but not yet in use, because the still existing stock of older constructions is still so abundant, that it was resolved to use up these first. In the meantime in 1919 a new joint was designed for rail No. 2, with the same type of fish-plate as model 1915 (see hereunder).

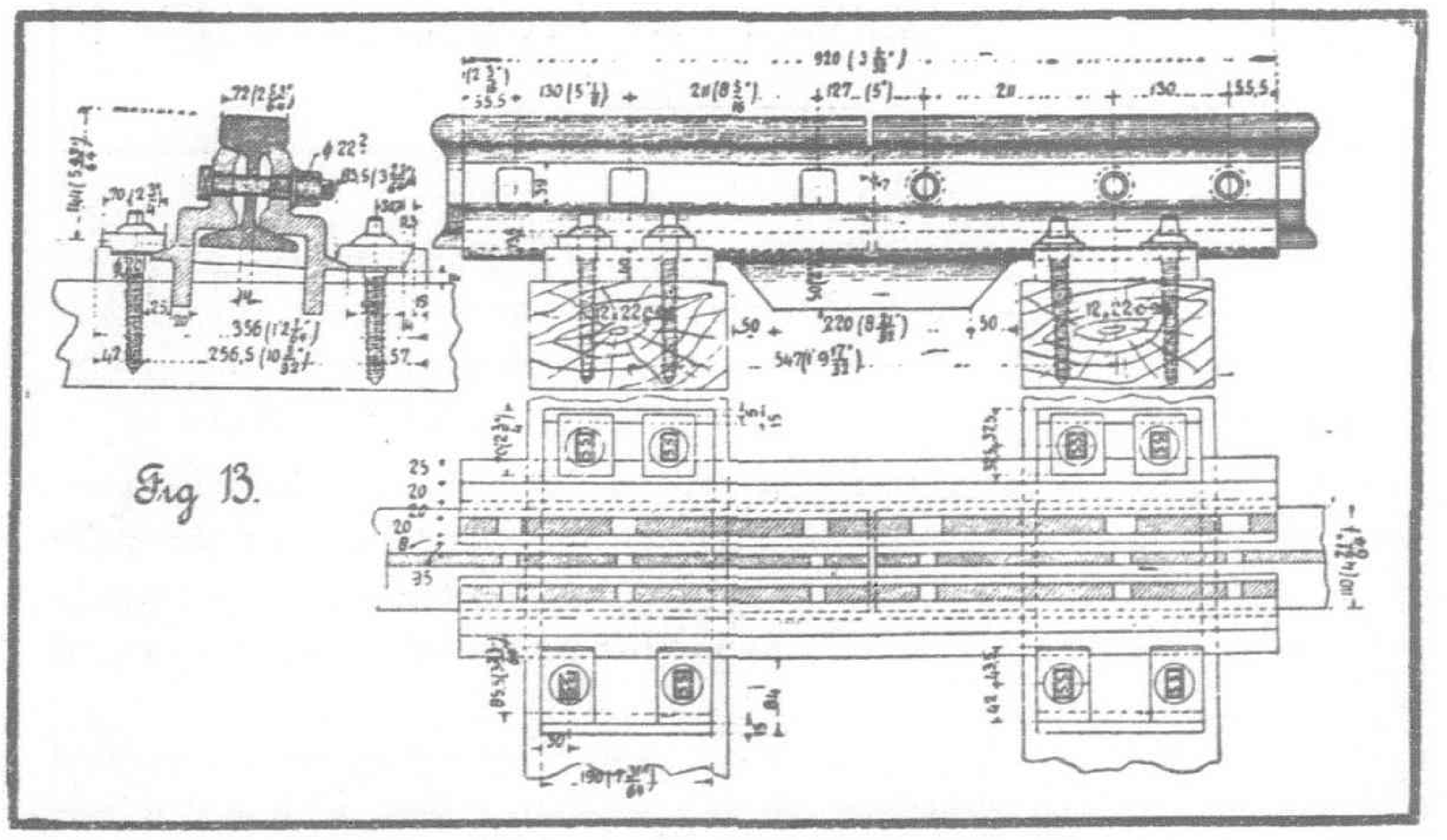


Fig 13.

Model 1915. This model projected for rail No. 3, is of the same type as model 1919, represented by Fig. 13 for the Prussian profile No. 15.

About model 1915 some details are already given sub 4.

The joint construction 1915, system Dr. Haarman (named by him "the joint with flanged-out fish-plates"), is the result of theoretical considerations, dealt with in his work, referred to sub 4b.

Model 1919 (see Fig. 13). The same joint-construction as model 1915 is applicated on rail No. 2 and on the new rail-profile of 45 to 46 K.G./M.

15. *Material of Fish-plates.*—The material is ingot-iron of a tensile strength of 40 to 50 K.G./m.M², whilst the product of tensile strength and elongation at the least must amount to 900. Thus the elongation amounts to a minimum of 25 to 18 per cent.

The Sole-plates

16. *Description of Different Models.—From 1875-1889* few sole-plates were used, or not at all. The inclining position of the rail was obtained by adding the sleeper. *From 1889-1900* flat sole-plates were used, 6 m.m. thick, and fixed by dogspikes. With the sole-plates, the sleepers still must be added under the sole-plates.

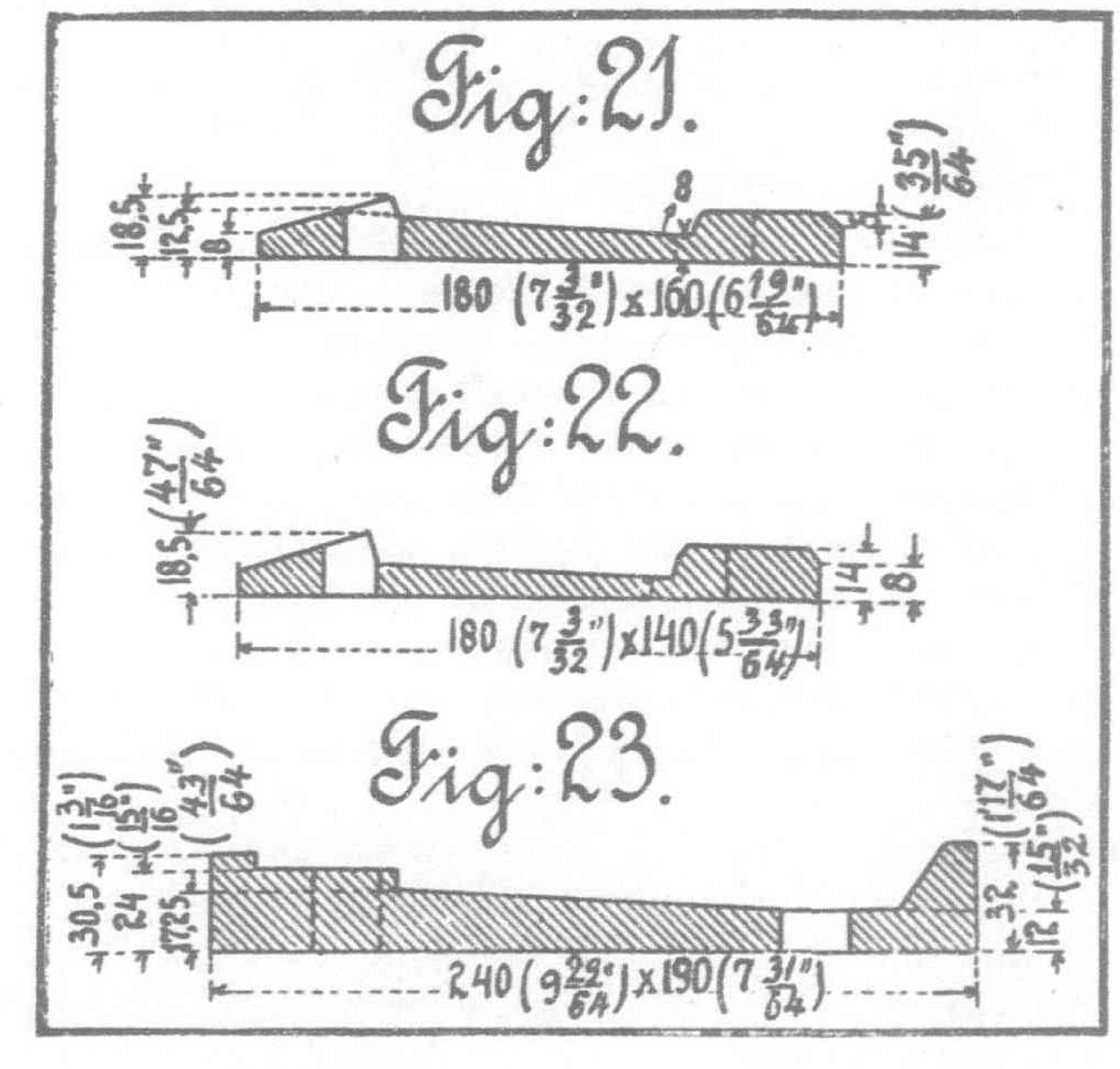
The sole-plates now were applied as follows :

(*a*) On the straight line and in curves of more than 400 metre radius, only on the sleepers at the joints.

(*b*) In curves of 300-400 metre radius moreover a sole-plate was put on the middle sleeper under the outer rail.

(*c*) In curves of a radius of less than 300 metre, a sole-plate is used alternately on the sleepers, but also only under the outer rail.

From 1900 until now, for rail No. 2 are used the models 1900 (see Figs. 21 and 22). From 1900 to 1909 for rail No. 2 the sole-plates were applied alternately, since 1909 on all the sleepers.



The minimum thickness of 6 m.m. is increased to 9 m.m. The sole-plates on the joint sleepers are 18 c.m. long, 16 c.m. wide (Fig. 21) and are fixed by two railscrews at the inside and two dog-spikes at the outside. These plates are also used on the sections A, B and C under the outer rail of curves of 400 metre radius or less.

On the other sleepers the plates are 18 c.m. long, 14 c.m. broad (Fig. 22) and are fixed by a railscrew at the inside and two dog-spikes at the outside.

From 1909 until now, for rail No. 3 on wooden sleepers is used model 1909 (Figs. 23 and 25) and model 1915, and on iron sleepers model 1910. About these models the following is to be said :—

Model 1909 (Figs. 23 and 25). When in 1909 a new superstructure was constructed for rail No. 3, of course a heavier sole-plate was also necessary. The sole-plates were then used on all the sleepers.

On the joint sleepers are used plates of a length of 24 c.m., 19 c.m. wide (Fig. 23) with holes for railscrews ; on the other sleepers the plates are 24 c.m. long, 16 c.m. wide (Fig. 25) with three holes for railscrews.

Model 1910 (on iron sleepers, Fig. 26). These sole-plates are 21 c.m. long, 12 c.m. wide with a hook at the outside and a hole for a holding-down bolt at the inside.

Model 1915 (system Haarman, Fig. 24). On the sleepers at the joints are used plates, 34.5 c.m. long, 19 c.m. wide with four holes for railscrews. On the remaining sleepers plates acc. to Fig. 25.

Fig 24.

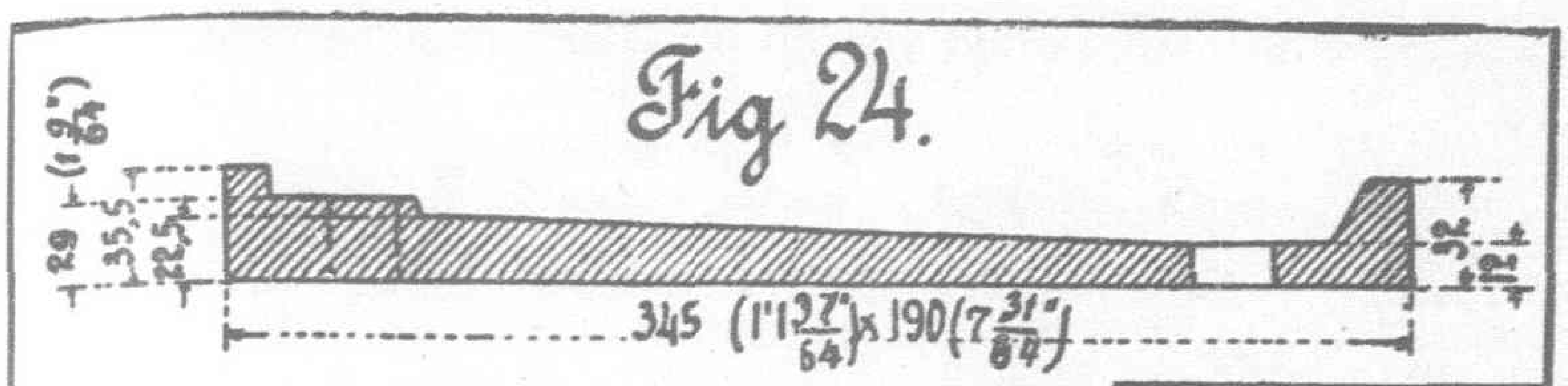


Fig: 25.

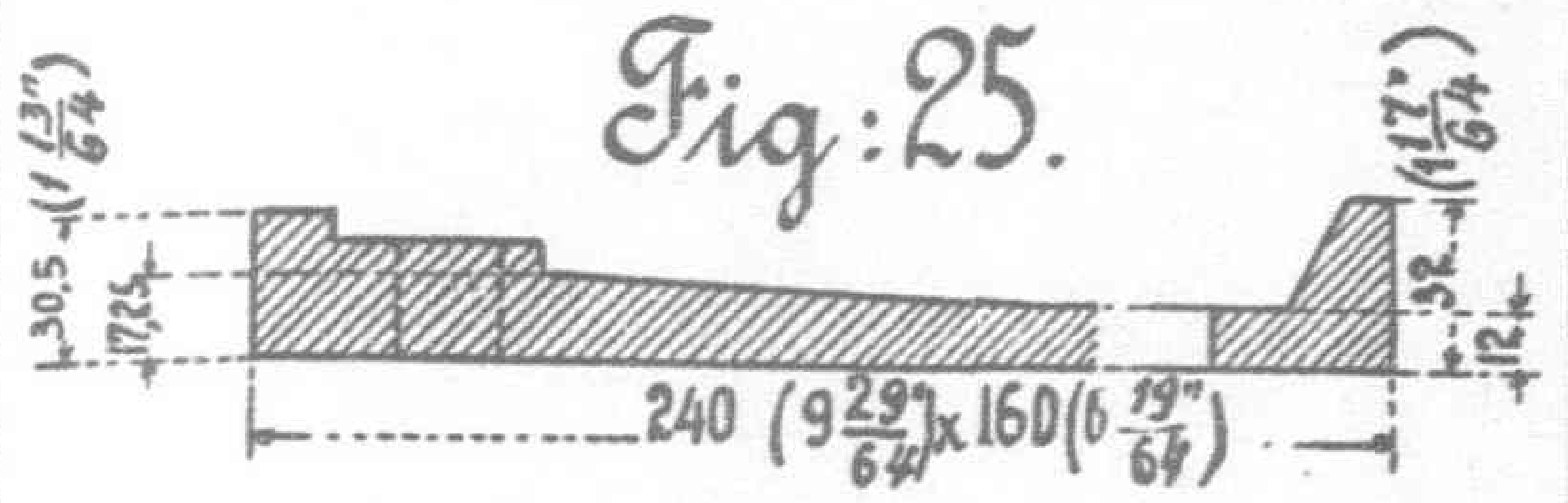
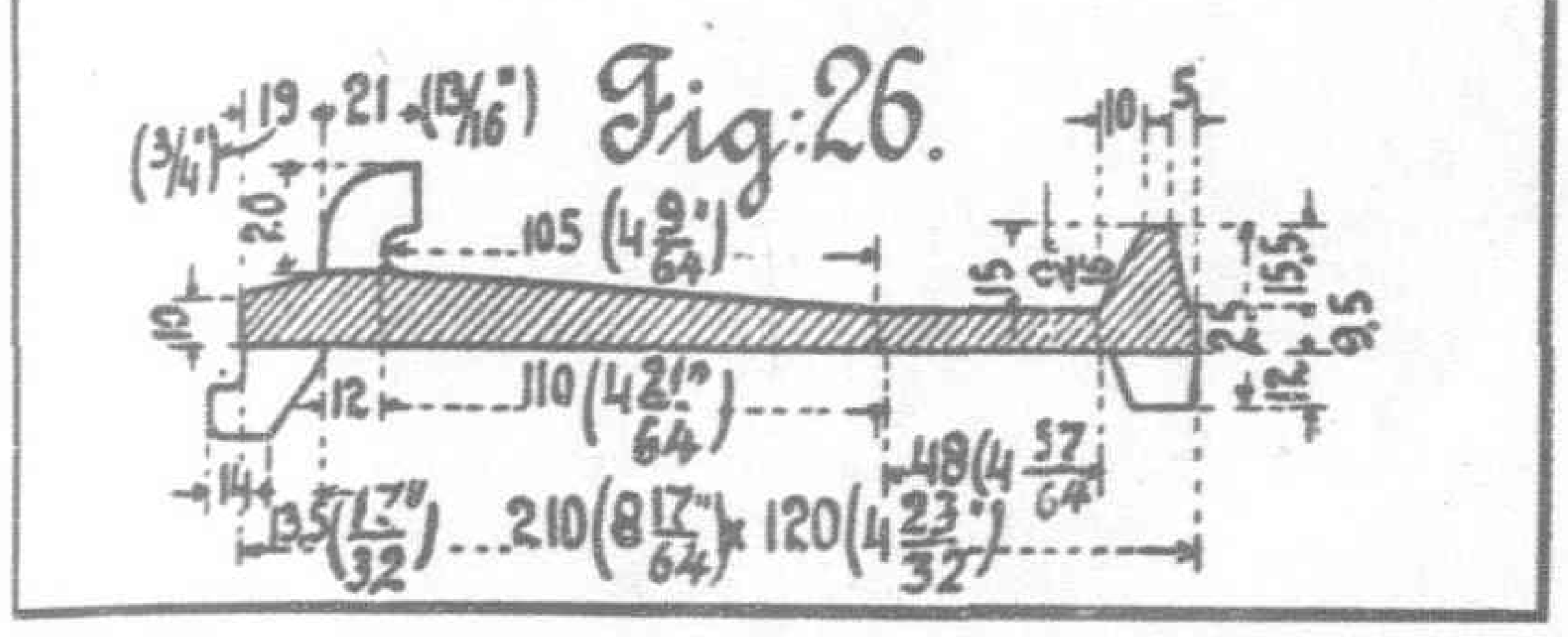


Fig: 26.



The Sleepers

17. *Material and Dimensions.*—Used as material are: Djaty-wood, iron-wood, hard kinds of wild-wood, red deal and ingot-iron. By preference are used djaty-wood (teak) and iron-wood. Sleepers of red deal are not bought any more, because notwithstanding the use of preservatives, they must be replaced after some two years of service. The normal dimensions of wooden sleepers are: length 2 metre, width 22 c.m., height 12 c.m. Originally, from 1875 to 1900, the length was two metres. In 1900 this was increased to 2.20 m., which length in 1909 again was reduced to 2 m., whilst the number of sleepers per rail-length was increased. Dr. Haarman demonstrated in 1909, that in connection with the stresses, caused in the sleepers, the most economical length for the gauge of 1067 m.m. is 2 metres. It is a better method to decrease the pressure on the ballast by increasing the number of sleepers, than by increasing their length. On bridges the normal dimensions are: length 1.80 m., width 22 c.m., height 18 c.m. The iron sleepers also have a length of 2 m. For the other dimensions see Fig. 12.

18. *The Distribution Under the Rails.*—The distribution under the rails is taken as follows:

From the rail-end the first sleeper lays at a distance of 22 to 27 c.m. The remaining sleepers are distributed regularly under the remaining length of the rail. The greatest sleeper-distance, centre to centre, amounts to: *Under rail No. 2*: On the mainlines on straight track 81 c.m. and in curves of $R < 400$ m.: 70 c.m. *Under rail No. 3*: On the mainline in the straight track and in all the curves 72 c.m. for wooden, and 73 c.m. for iron sleepers.

It is intended to take the maximum distance between 60 and 65 c.m. for sleepers under the type of rail of circa 45 K.G./M. not yet used for the heaviest loaded tracks.

19. *Switches and Crossings.*—About switches and crossings of the S. R. nothing peculiar can be said. The switches are of the well-known construction, with pivoted, or with spring points.

20. *Turntables.*—The largest turntable in use by the S.R. has a diameter of 20 metre. These turntables do not differ much from the well-known constructions. About the turntable of 20 m. it is worth mentioning that it is suspended by means of a pair of heavy wedges, which makes it possible to regulate correctly the height of the table. The turntables nowadays are too heavily loaded, sometimes with 50 to 100 per cent. more than they are calculated for originally. As a fact the turntables of 20 m. diameter also have become too small for the 1—D—D—0 locomotives (although these are well turned thereon) a new turntable of a diameter of 27 to 30 m. is in course of construction. Probably this will be moved electrically. In Fig. 3 is given a scheme of the heaviest type of locomotive, for which the turntable is calculated. The S.R. considers the possibility that a similar type in future will run on their lines.

The Formation and the Ballast-bed

21. *The Formation.*—The profiles of the formation are given in Figs. 17 and 18.

It is observed with Fig. 17, that the slopes of the taluds depend upon the kind of ground. The slope of b=that of a; the slope c may be steeper. The measure k is fixed according to Figs. 19 or 20.

22. *The Ballast-bed* (see Figs. 19 and 20).—The thickness *d* of the ballast-bed amounts to 0.35 m. at the sections A. B and C, when there is a good sub-soil, with particularly good sub-soil 0.25 m. For sections D respectively 0.25 and 0.20 m., sometimes even less until 0.10 m.

For ballast broken stone, gravel and sand is used. Broken stone and gravel, when of a hard quality, give the best ballast-bed

Fig: 17.

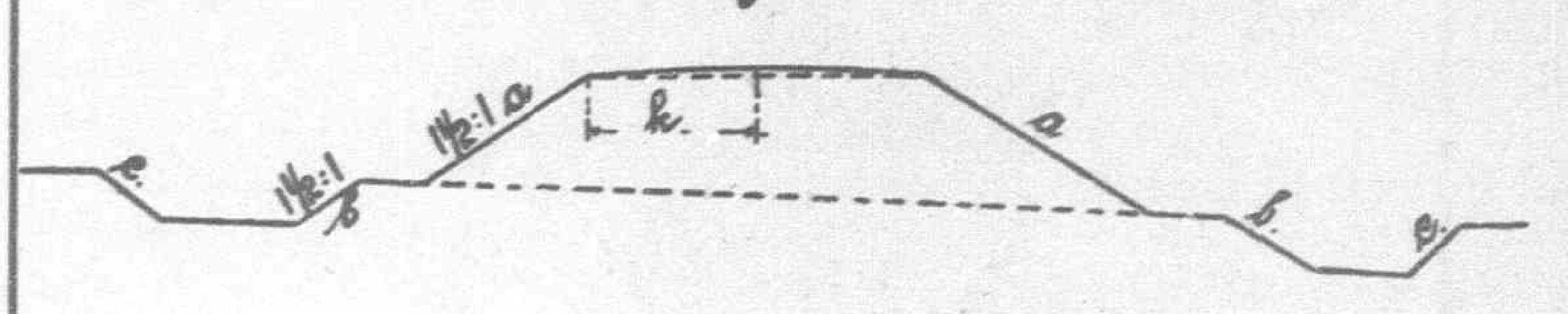


Fig: 18.

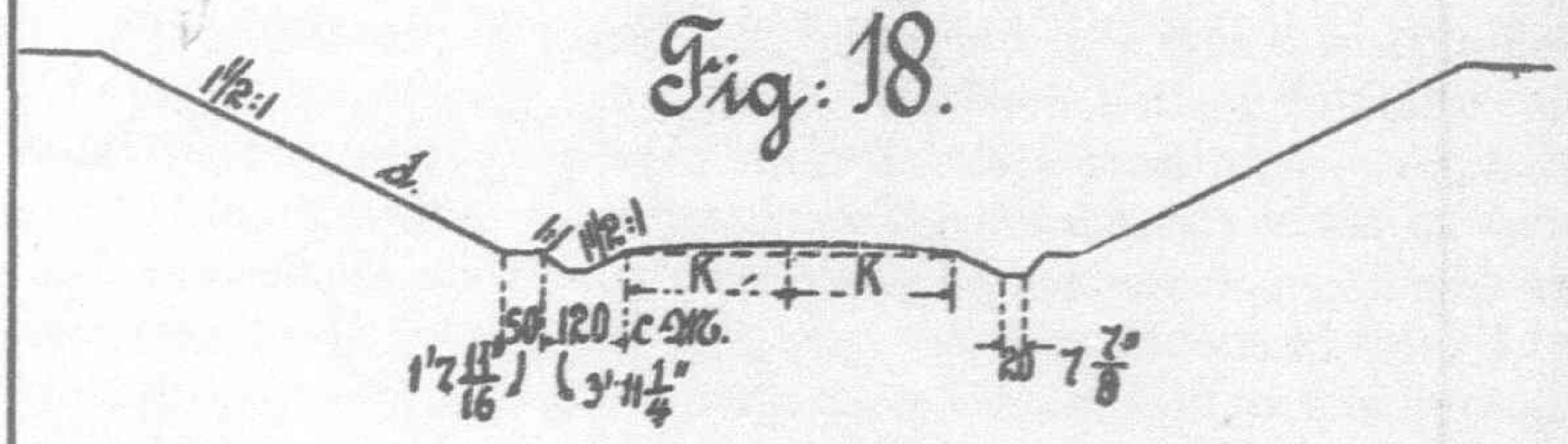


Fig: 19

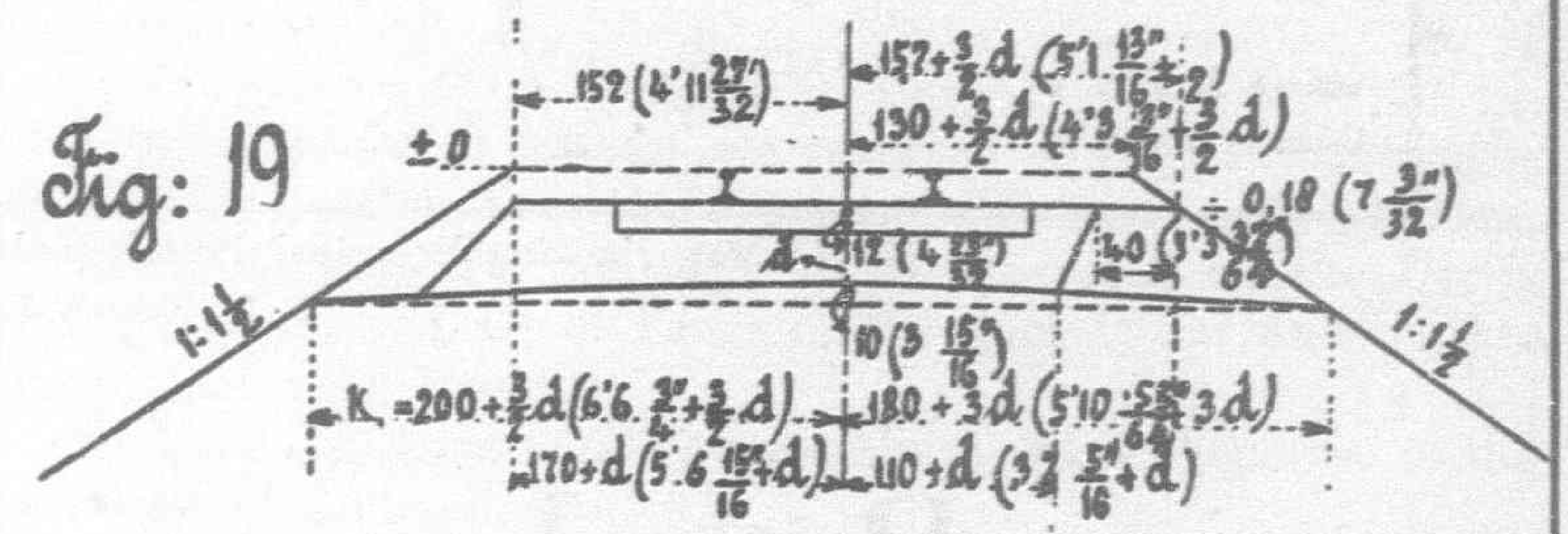
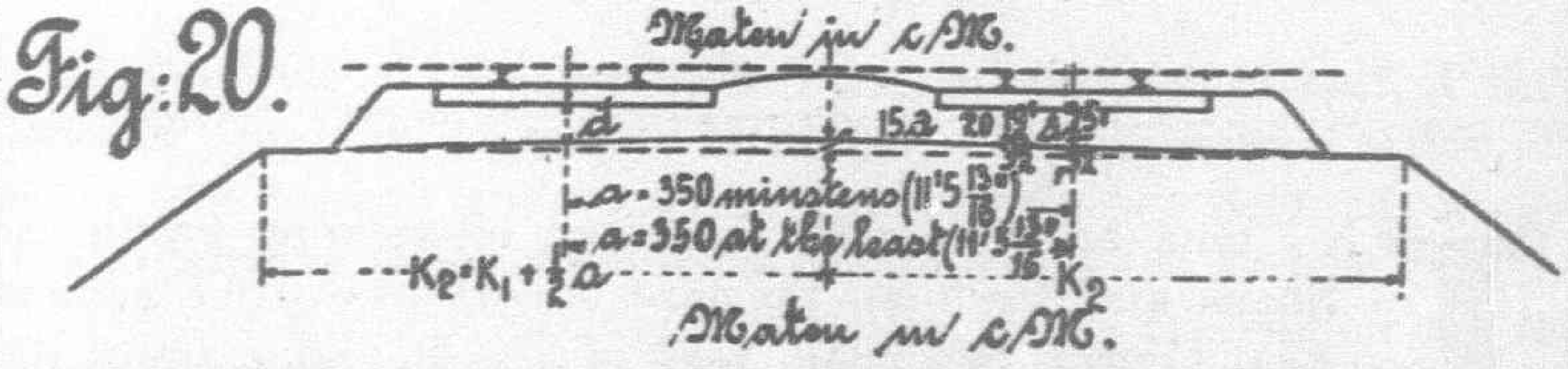
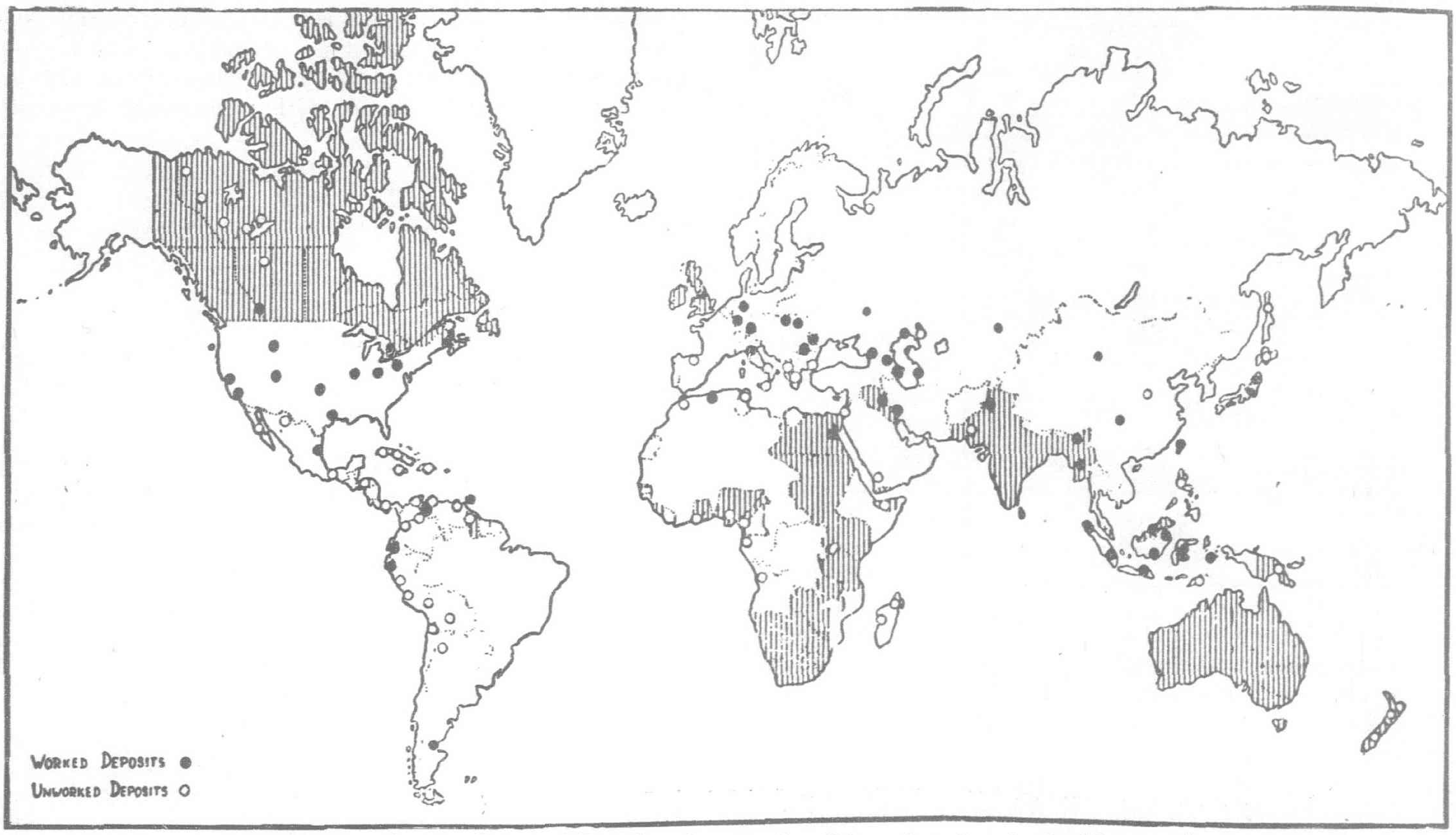


Fig: 20.



A Valveless Gearless Engine

Any user of internal combustion engines will need no strong argument for the advantage of doing away, if possible, with valves and gears, both of which are a fruitful source of operating difficulties. The idea of an engine without valves or gear has been realized in Great Britain by the construction of an engine which, in the works at least, has given remarkably promising results. This engine has three cylinders; and except for the parts it has no valves. There is not a single gear wheel and all the usual cams, shafts, tappets and springs and even the timing gear are cut out. The only moving parts are the crank shafts, pistons and connecting rods. The experimental engine was rated at ten horse-power and on test developed twice as much. The cycle of operations is not easily described without a detailed diagram but it must be said to depend upon ingenious inter-working between the three cylinders. This engine has been specially designed to meet the conditions in overseas countries, where an extremely simple engine not requiring difficult repairs is for obvious reasons in great demand.



World Map showing Principal Petroleum-bearing Localities referred to in the Monograph
(British Empire shaded)

Petroleum in Eastern Asia

China

IN China are two well-recognized oil-yielding provinces, Shensi and Szechuan, the most important district being in East Central Szechuan, west of Tze-liu-ching, about 100 miles west of Chungking and south of Chintu. About 18 miles south of Tze-liu-ching there is also a heavy seepage, and gas is constantly emitted from crevices in the rocks. There are about 50 wells in operation in this province, the majority of which are in the Tze-liu-ching district. The production of the province amounts to about 30,000 barrels a year.

The production of oil in China has hitherto been entirely incidental to the salt industry, in which it is used as fuel. The wells have been stated to yield from 15 to 50 per cent. of oil, and from 50 to 85 per cent. of brine, the average proportion being about 33 per cent. oil and 66 per cent. brine. The crude oil so far produced burns with a clear flame and is a good illuminant.

The geological formations in China as they have been reported, follow:

Tertiary sandstone, yellow.
Limestone, grey.
Sandstone, red.
Oolite, orange-colored, with petroleum at 600 feet.
Limestone, yellowish, with gas at 300 feet.
Marl, bluish grey, iridescent, white Permian chalk with brine 12 to 15 per cent. at 1,000-1,800 feet.
Schists, greenish, strong brine and flow of gas at 2,500-3,300 feet.

Imports of oil mainly consist of kerosene from the United States and the Dutch East Indies.

There is tank storage at both Hongkong and Shanghai, principally for fuel oil for bunkering purposes.

Dutch East Indies

The islands of Borneo, Sumatra and Java, rank amongst the most important known sources of petroleum, and indications of oil in commercial quantities have also been found in the Celebes and Ceram islands.

The principal producing areas are: (*a*) in Dutch Borneo, the Koetei and Tarakan areas on the east coast, covering about 500 sq. miles; (*b*) in Sumatra, Langkat in the east, Perlak in Atchin residency, and Palembang in the south; and (*c*) in Java, Semarang, Rembang and Soerabaya provinces in the north-east.

The oil-bearing strata are of Tertiary age, and generally associated with coal and lignite.

Borneo crude oil from Koetei has been found to contain an exceptionally high proportion of aromatic hydrocarbons, and is therefore valuable as a source of high explosive material, particularly toluol. Tarakan petroleum is a natural fuel oil, while Sumatra produces an oil very rich in petrol.

In the Koetei district of Dutch Borneo, the oil occurs mainly in Miocene sandstones, along anticlines with steeply-dipping sides, and is associated with heavy gas-pressure. The shallow sands in the Koetei fields yield heavy oil of 0·970 specific gravity, with paraffin. The lighter oils from deeper sources are poor in paraffin, and possess a specific gravity varying between 0·860 and 0·890.

The specific gravity of the Langkat oil of North Sumatra is given as from 0·771 to 0·857. In South Sumatra, the specific gravity of the oil from Meliamoen is from 0·765 to 0·775, of that from Kampong Minjak, 0·792, and of that of the oil from Babat, 0·812 to 0·889.

In Java, the chief petroliferous horizon occurs at the junction of the Upper and Middle Miocene; the wells are quite shallow, varying in depth from 500 to 800 feet, and require pumping. The oil has a specific gravity of from 0·825 to 0·916, and is of asphaltic base, yet yields paraffin wax of high melting-point.

Production (in metric tons) for the period 1905-1920 has been as follows :

—	Dutch Borneo.	Java.	Sumatra.	Ceram.	Total.
1905	439,487	110,711	513,630	—	1,063,828
1906	387,455	111,378	602,501	—	1,101,334
1907	489,151	142,983	713,841	—	1,345,975
1908	511,049	137,013	738,588	—	1,386,650
1909	411,506	140,351	922,894	—	1,474,751
1910	633,472	142,503	719,740	—	1,495,715
1911	814,707	172,438	683,523	—	1,670,668
1912	671,662	184,989	621,481	—	1,478,132
1913	797,059	207,135	529,947	82	1,534,223
1914	866,718	226,590	475,423	487	1,569,218
1915	893,896	256,838	491,611	1,100	1,643,445
1916	957,395	243,442	526,080	3,263	1,730,180
1917	869,123	232,636	583,384	2,248	1,687,391
1918	999,174	225,879	478,068	3,554	1,706,675
1919	1,372.006	235,814	477,977	7,120	2,092,917
1920	1,455,128	311,677	496,351	20,980	2,284,136

Japan and Formosa

Japan.—The belt of oil-producing territory extends along the west side of North Japan, from the west coast of Sakhalin Island on the north, along the coast of the Sea of Japan, through the west side of the central mountain range of Hokkaido, thence stretching across the provinces of Mutsu, Ugo, Uzen, Echigo and Shinano, to the Pacific coast of Totomi in the south. The principal producing districts are Akita in the province of Ugo and Niigata in the province of Echigo. The producing sandstones are of Tertiary age, interstratified with beds of slate or shale, and most of the production is obtained from shallow wells less than 700 feet in depth.

Drilling first took place in Echigo in 1890, when the Nippon Oil Co. successfully brought in a well in the Amaze field, and the development of other districts rapidly followed. The first gusher was brought in at Kurokawa, in the Akita district, in 1914, with an initial production of 10,000 barrels a day. Several others have since been obtained, and in 1916 a new field was proved along an anticline in the Urayama district, parallel with a similar fold in the Kurokawa field. The output has, however, gradually declined, that of 1918 being 101,728 tons less than that of 1915.

The total production for the years 1901-1920 has been as follows :

Year.	Tons.	Year.	Tons.	Year.	Tons.
1901 ..	159,527	1908 ..	294,549	1915 ..	442,793
1902 ..	172,023	1909 ..	268,913	1916 ..	425,415
1903 ..	172,853	1910 ..	246,748	1917 ..	411,768
1904 ..	202,782	1911 ..	248,231	1918 ..	342,814
1905 ..	210,400	1912 ..	236,659	1919 ..	285,000
1906 ..	243,682	1913 ..	274,844	1920 ..	280,000
1907 ..	284,886	1914 ..	388,810		

Formosa.—Indications of petroleum, which have been discovered in Formosa in about 300 localities, occur in 26 oil belts extending for at least 400 miles along the west coast. The Byoritsn and Tabanti fields in the north have already been proved, and the Nairo and Kosempo fields in Ako district, the Senschuiryo field in Tainancho, and the Rokiyukei field in Kagicho are all being exploited.

Distillation of an average sample of the oil gave the following results :—

Specific gravity of crude oil	.. ..	0.8284
Motor spirit (under 150° C.)	.. ..	10%
Kerosene (150°-300° C.)	.. ..	80%
Heavy oil (paraffin and residue)	..	10%

The production since 1906 has been been as follows:

Year.	Tons.	Year.	Tons.
1906	713	1913	2,586
1907	1,090	1914	2,387
1908	1,186	1915	2,702
1909	919	1916	2,753
1910	520	1917	2,791
1911	234	1918	1,926
1912	493		

Philippine Islands

Petroleum occurs as a very light paraffin-base oil, at various points in the Philippine Islands, notably in the Bondoc Peninsula, at Toledo and Algeria in the island of Cebu, and at Tayabas and Luzon. Indications are also reported to occur on the islands of Palawan, Leyte and Mindanao, whilst the islands of Panay, Guimaras, Negros and Bohol appear worthy of further investigations.

Bondoc Peninsula.—American interests recently sent out a geological expedition, and, as a result of favorable reports of petroleum indications, are actively sinking test wells.

Cebu Island.—In 1914 a company was reported as formed for exploiting the petroliferous areas of Toledo.

Sakhalin (Russian)

For a distance of nearly 200 miles and in a belt 6 to 12 miles wide along the Pacific coast of the northern half of Sakhalin, oil indications have been reported in the Tertiary sandstones. Asphalt is found in all stages of density, from the consistency of tar up to a hard, smooth-surfaced mass resembling an asphalt floor. The lake near Oha Creek, over 1,000 feet long, 400 feet wide, and from 2 to 6 feet deep, is estimated to contain more than 25,000 tons of a tough asphalt-like substance comparatively free from foreign matter. Little development work has so far been done.

Syria

Large deposits of asphalt are reported to exist in the neighborhood of Latakia, near the villages of Kferie, Cassab, Ghoman, Chmeisse, Khorbe and Sonlas ; also at Hasbeya, on the Upper Jordan, Sahmur and Ain-et-Tineh, on the Nahr Latini, and another Ain-et-Tineh near Magluda.

In Northern Syria a petroleum spring has been reported to the south-east of Alexandretta.

Timor (Portuguese)

Indications of oil have been found in the eastern half of the island of Timor, belonging to Portugal, where limestone is found coated with asphalt and ozokerite, yielding 24 per cent. of crude oil, and pools of black viscous oil are found on the surface.

There are many natural difficulties to be overcome, but it is thought that oil may exist in quantity at a depth of from 1,200 to 1,500 feet in a Triassic formation, and investigations are to be made with a view to a practical test later, if the conditions are favorable. Unfortunately, the geological formations are much disturbed by earthquake action. Many prospectors of various nationalities have visited Timor, but have abandoned their concessions.

One sample of oil from Timor, of specific gravity 0·840, gave a flash-point (Abel close test) of 112°. Another sample yielded 64.6 per cent. of kerosene and about 30 per cent. of intermediate lubricating oils.

Indicating and Recording Locomotive Speeds

Much of the improvement of the locomotive which has been achieved recently is due to the very accurate measurement of performance. Some years ago a British firm brought out an indicator which shows and records the speed of a locomotive by drawing curves on a time basis. A demand arose for an instrument giving records on a distance basis ; and the same company has now produced an instrument for that purpose. One great advantage of records on a distance basis is that the exact speed on every gradient and curve or bridge can be at once ascertained. Thus an efficient check is kept on the driver, who is under obligation to reduce speed on certain parts of the line. Although the instrument is much too complicated for a short description it is so robust and so well designed that only three parts require lubricating more frequently than is needed for ordinary enclosed clock mechanism.

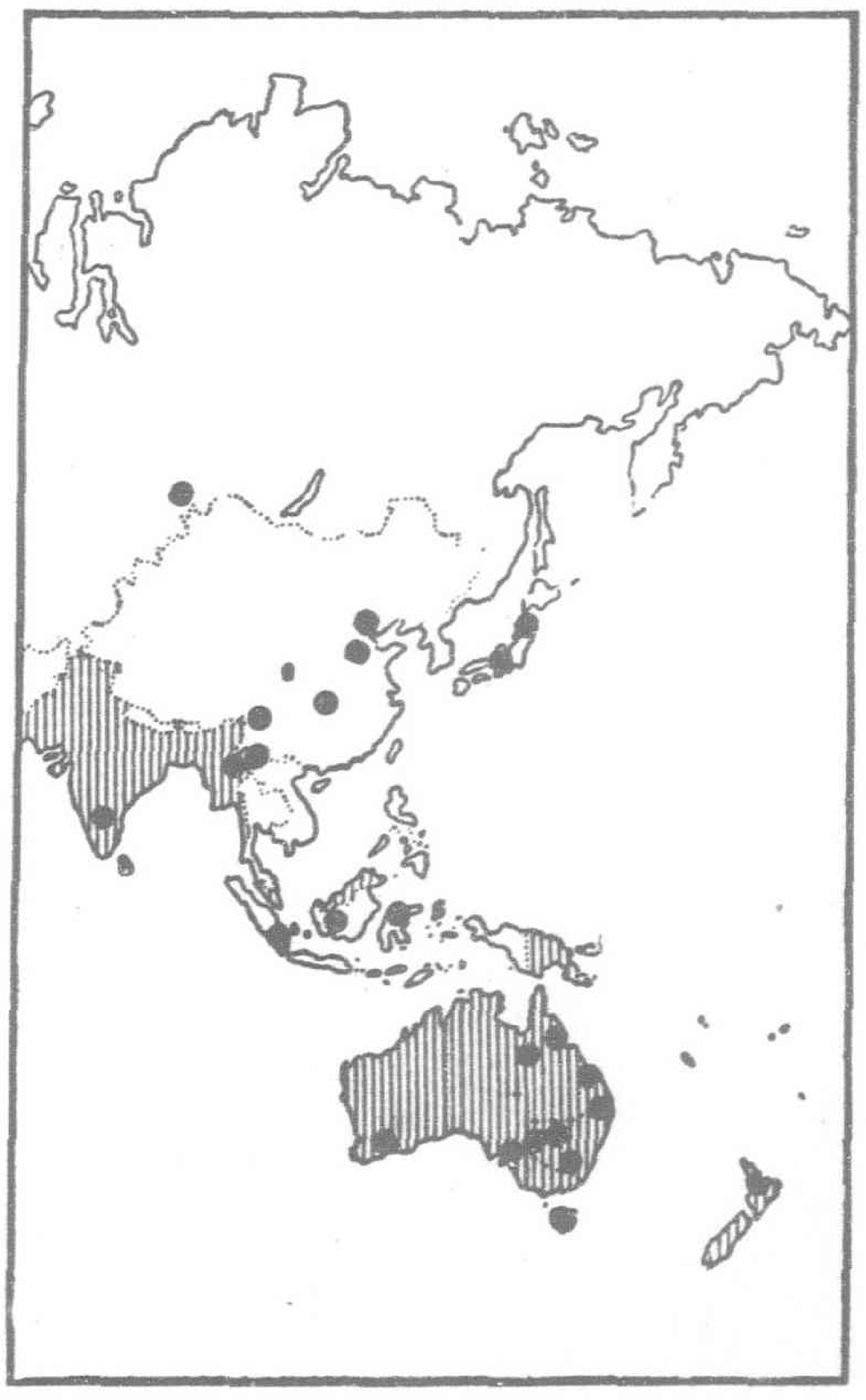
Silver in Eastern Asia

China

IN Chili and North Shansi (North China) silver is obtained from deposits of argentiferous galena. At Tenyungshang, in the Jehol district of Mongolia, a vein occurs in limestone near the contact with metamorphic schists. It is worked by the Chinese. The vein strikes E.-W. and dips N. 50°–70°. The galena carries 300 to 500 oz. of silver per ton, and blende, also present, 12 to 18 oz. per ton. In the Qusantzu mines, seven miles east of the last, galena with tetrahedrite carries 100 oz. of silver per ton, and occurs in a vein with the same strike and dip and in a similar formation.

In Szechuan (one of the south-western provinces) the Maha gold mine is said to carry a considerable amount of silver. At Lokutetye are veins bearing free gold and lead ores high in silver (300 oz. per ton). At Matasa is a vein of silver-lead, which is said to produce 122 oz. per ton, and another vein bears argentite. At Tachienlu are the government silver mines producing 75 to 90 oz. of silver per ton. The vein is 4-ft. wide and is worked along its strike for over 10 miles. This vein contains complex ore carrying copper, silver and lead, but it is only worked for its silver content. Near Yershe are veins of gold, silver and copper ore, and in the south-eastern district are veins carrying silver-lead.

At Fukea are numerous veins containing copper and silver ore. These mines supplied the greater part of the silver used in the Tang dynasty. Near Huilechao are numerous veins of gold, copper and silver ores, which are worked extensively by the aborigines. In the Yenyuan district are veins carrying gold, silver, lead, copper, zinc and also mercury.



Map showing the Silver-producing Districts referred to in Text
(British Empire shaded)

In the Hunan province, Central China, is the Shuikoshan zinc and lead mine. The country is limestone (probably carboniferous) overlaid by red sandstones and shales of cretaceous or tertiary age. Large irregular-shaped bodies of ore, composed of blende and galena with pyrite and chalcopyrite, are developed in the limestone at and near its contact with syenite. The latter has small crystals of chalcopyrite disseminated through it. The deposit was the direct result of the metasomatic action of the mineral-bearing solutions emanating from the magma. Lead concentrate contains from 9 to 38 oz., and zinc concentrate from 2.5 to 15 oz. of silver per ton. The only other deposit with an important output is that of Kungshan in Tungchwan (Yunnan province), where the principal ores are carbonates. The production from the Weihungchow district, Kweichow, is chiefly silver.

The amount of silver produced in China in 1914 was insignificant, and probably did not exceed 50,000 oz.

For 1917 the production is given as 63,900 oz., and that of 1918 as 70,000 oz. (U.S. Bureau of the Mint).

Dutch East Indies

Borneo.—A vein near Budok, Dutch Borneo, contains sylvanite (a telluride of gold and silver).

In the Kahajang mine, of the central auriferous district of Dutch Borneo, there is some silver in the ore.

Celebes.—The sulphide gold ores at Palehleh, on the north coast, contain 12 oz. of silver per ton.

Sumatra.—In the Redjang-Lebong lodes the ratio of silver to gold in the bullion is often as high as 10 to 1. In 1906 and 1907, the mine produced 248,240 and 327,584 oz. of silver respectively.

In Western Sumatra, from Tjalang to a point on the coast opposite the island of Poolo Raja, garnet and wollastonite lenses occur in ancient schist, which carry copper (as bornite), gold, silver and some platinum--silver being by far the chief product.

Japan

Silver-mining in Japan dates from a very early period, the oldest records referring to the discovery of silver ore in the island of Tsushima, in the year A.D. 674. From then until the year 1896 many deposits were opened up, but during the course of the next few years a number of these had to be abandoned on account of the fall in the price of silver.

The production of the metal gradually increased from 1874 to 1895, but from 1895 to 1904 remained nearly stationary, in spite of the rapid progress made by the gold and copper industries. In 1905 there was a considerable increase in the production owing to the conspicuous development of the Kosaka mine and the general increase of the silver production in the gold and copper mines. The great increase in 1908 was due to the development of the Tsubaki mine, and the total output for that year was more than 17 times the output in 1875, and 2½ times that in 1900. Generally speaking, the production of silver extracted from silver ores proper is declining, but the total output is maintained or increased by the increasing amounts of the metal obtained as a by-product in the treatment of gold and copper ores.

Production of Silver in Japan, 1880 *to* 1919

Year.	Troy Oz.	Year.	Troy Oz.
1880	332,406	1915	5,120,293
1890	1,699,029	1916	5,805,700
1900	1,890,716	1917	7,111,700
1910	4,581,613	1918	6,600,400
1913	4,649,910	1919	5,163,068
1914	4,836,228		

(U.S. Bureau of Mint.)

Production of Silver by the Principal Japanese Mines in 1919

Mine.	Locality.	Troy Oz.	Mine.	Locality.	Troy Oz.
Hitachi ...	Ibaraki	1,355,857	Sado ...	Niigata	171,252
Saganoseki ...	Oita	902,029	Ikuno ...	Hyogo	171,146
Ashio... ...	Tochigi	581,304	Yoshioka ...	Okayama	132,637
Kosaka ...	Akita	559,991	Abeshiro ...	Aomori	132,616
Kamioka ...	Gifu	222,796	Other mines...	—	752,660
Mitsui-kushikino	Kagoshima	180,780	Total ...	...	5,163,068

The production of the twenty most important mines during the five years prior to 1908 aggregated 85.2 per cent. of the total output. The greater part of the silver produced by these mines came from argentiferous lead ore; 18.6 per cent. from normal or dry silver ore, and 15.7 per cent. from argentiferous copper ore. It is to be noted, however, that there is a tendency for the output of silver from copper ores to surpass that derived from dry silver ore.

The silver deposits, whether in the form of veins, impregnations, or metasomatic replacements, are practically confined to tertiary volcanic flows of liparite and andesite and tuffs of the same age. On the other hand, the economically unimportant contact-metamorphic deposits are restricted to the region occupied by pre-tertiary rocks.

Several of the principal mines exploit dry silver ore as well as argentiferous lead and copper ores, which occur as lodes traversing eruptive and sedimentary rocks of tertiary age. Of considerably less importance are argentiferous lead and copper ores which occur as impregnations in tertiary rocks. With regard to deposits of the metasomatic type it is stated that, although great numbers of such deposits exist, the only one actually explored is the so-called Kuroko deposit. The Kuroko deposit was worked in conjunction with the Tsubaki mine, which in 1908 yielded the greatest output of silver of any mine in Japan.

Numbers of deposits of the contact-metamorphic type are known, but only a few are important, such as those at Kamioka and Hiragane in Hida. These occurrences are very commonly situated at or near the contact between igneous intrusions and Palæozoic or pre-Cambrian strata.

The Tsubaki mine, opened in 1889, no longer produces. The country rock consists of tertiary shales and andesites. The ore is the so-called "kuromono" or "black ore," a mixture of argentite, blende, galena, pyrites, chalcopyrite, barytes, quartz and calcite. It contains generally 0.07 per cent. of silver, but the richer parts yield 0.15 per cent. to 0.3 per cent of the metal. The Kosaka mine was opened in 1866, and is one of the most important in Japan. The ore is of the kuromono type and yields copper, silver and gold, and occurs as a large mass in tertiary tuff near its contact with dacite. The Ikuno mines are said to have been started in 807, although it was not until 1542 that they were worked on anything like a large scale. There are two principal mines, namely, the Tasei and the Kanagase, which yield copper, silver and gold. The country consists of tertiary tuffs, liparite and associated rocks, and the ore is made up of argentite, native gold and silver, with chalcopyrite, pyrite, galena, blende, pyrargyrite, stibnite, quartz, calcite and rhodochrosite. These minerals occur in a series of veins. The Kamioka deposit is said to have been discovered about 1,200 years ago, and yields silver, copper and lead. The rocks are hornblende gneiss with limestone and intrusive quartz-porphyry, and the deposits, which consist of argentiferous galena, chalcopyrite, blende, actinolite, epidote, with calcite, quartz, pyrite, etc., occur as lodes.

Siberia

The silver-lead mines of Western Altai, government of Tomsk, were important in the early part of the nineteenth century. In Central Altai the deposits lie for the most part in carboniferous limestone and occur as lodes carrying silver-bearing lead ores mixed with a large proportion of barytes. Silver tellurides are also mentioned as occurring in these deposits. The mines have been worked out to depths of 700-ft., and operations did not apparently pay in depth. The deposits in the Salair mountains are very similar in their mineral contents, as likewise are those in the Kolybane district, but are stated to be much richer. The Zmeeff mine near Kolyban Lake, south of Barmaoul, exploited a particularly rich shoot of ore. Another rich group of mines is the Rydirsk group.

In 1845 the silver production of the Altai is given as 26,331 oz. and in 1891 as 313,462 oz.

Oil in the Philippines

By H. Edmund Bullis

WITH the tremendous increase in the world consumption of oil, the finding of petroleum in the Philippines is of tremendous importance. The experts from the bureau of science have for many years been investigating the possibilities of petroleum in the Philippines, and have located petroleum-bearing shales and oil seepages in several provinces, notably in the Bondoc peninsula, Tayabas province, Luzon, Leyte and in Mindanao.

The first real attempt to obtain oil in the Philippines was in 1896, when an English company started drilling on the Smith-Bell estate near Toledo, Cebu. This company had obtained the services of an experienced Pennsylvania oil driller and when their well was down about twelve hundred feet, they were surprised by insurrectos and forced to abandon their work.

Because of the enormous expense and the uncertainty of oil drilling operations, no real attempts have been made since that time until last year, when the Richmond Petroleum Company, a subsidiary of the Standard Oil Company of California, actually started operations on the Bondoc peninsula.

This company has been working for about eighteen months, preparing the way for the drilling work on the Bondoc peninsula. At the present time this company has leased approximately 36,000 hectares in this locality and during the past year the government has been pushing the cadastral survey in order to establish beyond doubt the ownership of the land which the Richmond Petroleum Company has leased. Due to the present uncertainty of ownership of a part of the land in this tract, it has been necessary in many instances to make contracts with different claimants to the property until the results of the survey have been made known and claims passed upon before the cadastral court.

Drilling for oil in the Philippines is certainly not a poor man's game, since it costs from two to three times as much to drill here as it does in California. The Richmond Petroleum Company has brought over approximately $200,000 worth of equipment and has twenty-four Americans actively engaged in the drilling operations. One thousand tons of machinery and supplies were landed upon the beach near the drilling site from the United States shipping board vessel *West Cahoot* in three and a half days, by lighters of the Atlantic, Gulf and Pacific Company. By means of a Holt tractor with two trailers, this material was transported to the camp, which is now adequately equipped with electric lights, an ice plant and a wireless station.

This company's first attempt at drilling was on a lease in the vicinity of the Amuguis river, three to three and half miles north of the southern extremity of Bondoc peninsula. The first drilling site is located on the south end of a low, broad dome or doubly plunging anticline. There are no natural indications of oil such as seepages or asphalt within this anticlinal area, but at Bacau, two miles north of the northern end, there is an excellent showing of very light oil near the Canguinsa river. The shale, when placed in water, yields a very thin sheet of oil which spreads very rapidly. There are several test wells at Banco, four miles northeast of the drilling site. A poor showing of oil shale occurs at Sili, about four miles northwest of the drilling site.

The drilling of the first well was with a rotary outfit for deep well drilling, and a seventeen inch hole was carried to a depth of 1,065 feet. At three hundred and fifty feet, in a fine grained sandstone, a fair showing of oil and gas was encountered. The thin, light oil spread over the mud, which came from the bottom of the hole as a return fluid from the rotating fish tail of rotary. A better showing was reported at five hundred and fifty feet, and this stratum has continued to yield combustible gas bubbling through the thick mud. While these indications are encouraging, they do not demonstrate an economic source.

At the depth mentioned above (1,065 feet), the hole caved in and it was necessary to put in 12½ inch casings. The operation was then continued to a depth of 1,323 feet, when caving troubles became so serious that drilling of the first well had to be stopped about the middle of May.

A new site has been selected about two miles from the first drilling site and a new attempt is being made. While this failure of the first well to produce is discouraging, it is only one of the trials connected with oil well drilling. The new well will be cased as it is drilled, which process, of course, will take much longer than the rotary drill process, but will prevent the caving in which occurred in the first well.

The Vigo group, the strata in which oil seeps frequently occur, is widespread throughout the Philippine Islands, and in many places, such as Mindanao, Cebu and Leyte, its shales are petroleum bearing. One and a half miles east of the barrio of Baliti, on the northwest coast of the island of Leyte, there is an indication that in *times past* there existed an economic source of petroleum. This exposure is in a fault block, and asphalt prospectors have developed in its north end a very excellent surface for study. This stratum is from fifty to seventy-five feet in thickness, and from visible outcrops appears to be about six hundred feet in width and six hundred feet in length. How much greater in extent it may be is unknown.

The rock composing this outcrop is a mixture of porous ash and pumice, which was laid down in the quiet waters of the Vigo sea. Numerous small animals have also contributed their limestone skeletal material to this rock. Later, this portion of the sea bottom was lifted, folded and its pores were thoroughly impregnated with petroleum. still later, faulting took place and the petroleum reservoir was cracked, while lighter portions of the petroleum evaporated, leaving in the twenty-five per cent. voids of the rock a thick, tarry, bituminous residue.

If the Richmond Petroleum Company succeeds in drilling into loose sandstone or tuff similar to this Leyte occurrence, it is quite possible that an economic deposit will be developed in the south end of the Bondoc peninsula.

If oil is found in commercial quantities, it cannot be determined at the present time whether or not refineries would be built on the field, or elsewhere in the islands, or whether the crude oil would be sent to other parts of the world for refining. At the present time, the only refineries in the Orient are the Dutch Shell Refineries in Borneo and Sumatra. If gas should be found in sufficient quantities with the oil, it might pay to build a refinery right in the field and the various by-products could be shipped from the refinery to the places of distribution. On the other hand, if little gas is found, and if the quantity of oil obtainable warrants, pipe lines could, undoubtedly be built to the ocean, where oil tanks could be erected as storage stations while waiting for the crude oil to be loaded on ships.

The importation of petroleum products into the Philippines is becoming a more important factor every year. The table published below gives some idea of the rapid growth of the use of petroleum products in the islands.

This table does not include the large amount of petroleum products used in the navy. It can be seen from these figures that if we could produce enough petroleum products in the Philippine Islands to satisfy our needs only, it would be an economic saving of nearly twenty millions of pesos per year. If extensive oil fields were found, we might have enough petroleum products to export to other places in the Orient.

The Richmond Petroleum Company is taking a great risk in this hazardous venture to prospect a practically virgin field for petroleum, and it is the hope of the American chamber of commerce that it will succeed in its undertaking.

IMPORTATION OF PETROLEUM PRODUCTS INTO THE PHILIPPINE ISLANDS (BUREAU OF CUSTOMS)

	1920 P.	1919 P.	1918 P.	1917 P.
Crude Oil	2,010,224	352,439	138,407	55,759
Naphthas, including all lighter products of distillation ..	7,666,168	4,795,364	1,106,229	1,672,755
Illuminating Oils ..	7,715,706	6,677,590	2,426,920	2,673,335
Lubricating Oils ..	1,248,260	1,251,405	796,718	538,615
Totals	18,640,358	13,076,798	4,468,274	4,940,464

Progress in the Field

To date there are sixteen petroleum companies which have made application for, or have been granted, leases in the Philippines. Of these only one is operating and two are exploring. The only operating company, the Richmond Petroleum Company of California, according to its third and latest quarterly report, had reached a depth of somewhat more than 300 metres in its first well on lease tract Amuguis No. 1, Bondoc peninsula, Tayabas province, Luzon, when caving in the hole became so bad that it had to be abandoned. A "show" of oil and gas was obtained at about 100 metres depth, but not in economic quantity. It was then decided to move the rig about 3 kilometres farther north to a point higher on the structure where it is expected that drilling will be resumed in October.

This company has a very complete equipment of up-to-date well drilling machinery, both standard and rotary machines, twenty-four American drillers and mechanics, and a large force of natives. The entire plant is very complete. In addition to erecting several buildings, the Company has had to build roads in virgin country. It has an ice plant, a necessity in this country, and also enjoys radio connections with Manila. Besides the operating force on Bondoc peninsula, this company maintains a central office in Manila and three field parties are engaged in geological investigations in various parts of the archipelago.

The public can get some idea of the methods of a large oil company, when it learns that a geologist of this company was on the ground for a year and a half before drilling was commenced, and this after the government had already done a great deal of preliminary exploratory work, which work was available to the company.

Copra in New Guinea

A little known source of copra is being developed in the former German possessions in New Guinea. The German owners of the plantations were allowed to continue operating them during the war, but as they were not permitted to send their profits out of the country, these were employed in clearing the jungle and in making extensive new plantations, which will be coming into bearing at different times during the next four or five years. It is expected that the existing production of copra will increase from the former 18,000 tons to at least 28,000 tons. It has been decided not to permit the importation of laborers from other countries, but to rely upon the native Papuans and Malaysians, who make fairly good cultivators. The former German laws relating to indentured labor have been abrogated and liberal regulations introduced under which there are now 30,000 laborers on the plantations in place of the 17,000 in 1914.

The Far Eastern Review

A Monthly Review of Far Eastern Trade, Finance and
Engineering, Dedicated to the Industrial Development
and advancement of Trade in Far Eastern Countries

ENGINEERING FINANCE COMMERCE

5 JINKEE ROAD, SHANGHAI, CHINA

Telegraphic Address: Farview, Shanghai

SHANGHAI, APRIL, 1922.

"The Policy of 'The Far Eastern Review'"

By Its Publisher

THE Treaty is ratified. The attitude of THE FAR EASTERN REVIEW has been justified by events. It is now possible to be more explicit in explaining an editorial *volte-face* which caused considerable comment in Far Eastern and American journalistic circles.

With the ratification of the treaty, comes a book entitled "An American Diplomat in China," which strengthens the position of THE FAR EASTERN REVIEW by a public confession of the exact nature and object of a campaign, which, in its inception in 1915, compelled me to retire from active journalistic work in China because I could not conscientiously support American policy as then interpreted by the last American minister to China. When, at the peace conference in Paris, followed by the campaign for war with Japan, it became clear that the nation was being railroaded into a dangerous position by Minister Reinsch and his co-workers, I determined that the time had arrived for the initiation of a counter-campaign that would bring about a solution of Far Eastern problems along more rational lines.

To do this I have had to present Japan's side of the case. I hold no illusions about Japan or her militarists, I hold no illusions about China, or her militarists. Notwithstanding my great sympathy for the latter country, it would never bear stretching to the point where I could advocate hostilities between America and Japan or demand a "show down" that the American people would not support. My sympathy has been with the Chinese people, and I have never swered from my original ideas except where it became essential to present Japan's side of the controversy so that Americans would have all the facts before them. My fight has been conducted against the activities of those Americans, who, like Minister Reinsch, induced the Chinese officials to believe that the United States would fight Japan single-handed in order to redress their real or fancied wrongs. I was told on my arrival in China nearly two years ago, that "I could not size up a situation." I couldn't, when it came to supporting the agitation against Japan, then at its height. I could, however, size up the situation in America. I knew something the agitators and sentimentalists overlooked. I knew the American people. I knew that the real red-blooded American would never go to war with Japan over China. I knew that Americans would never go to war with Japan without some initial aggressive move on her part. I knew that when it came to a "show down" the manhood of America would never accept quietly being hustled on transports to cross the Pacific to fight Japan, unless they were well satisfied that the safety of their own country was endangered. If, as I was assured time and again, by leaders of the rabid anti-Japanese movement," the United States must fight Japan; that war was inevitable; that now was the time, before she become stronger; then, there was every humanitarian and patriotic reason why all sides of the case should be aired. Never again will the people of the world be plunged into the horrors of war without a full knowledge of all sides of the facts, I knew, personally, of secret moves that had been made during the war by overzealous and mentally-warped Americans, in their endeavor to curry favor with China by attacking Japan. I also was well informed that in many small and petty ways the Japanese had well earned the ill-will of Americans, British and Chinese, and that an international association in North China was preparing an indictment of their activities during the war, but these deeds, to my mind, could never be stretched into a good reason why America, single-handed, should challenge Japan. I sensed that those most active in yelling for war with Japan would be most conspicuous by their absence from the fighting forces if hostilities were declared.

There was every good patriotic reason to fight such a propaganda, and when the attempt was made in March, 1920, to penalize this publication for its attitude, and every underhand, disreputable and questionable method employed to "put THE FAR EASTERN REVIEW out of business," I accepted the challenge. We have won. I can now express myself more freely and invite attention to the book by Dr. Paul S. Reinsch, entitled "An American Diplomat in China," published by Doubleday Page & Co., the first copies of which have just arrived in the Orient.

The title is a misnomer. A perusal of the book will reveal that far from being a diplomat in the strict sense of the word, Dr. Reinsch was the Poo Bah of Peking, the Shogun of China, the power behind the presidental chair, with a finger in every pie, consulted at all times by all manner and classes of Chinese from the president down the line through the cabinet, tuchuns, politicians and even unto the school children. However, that is a separate story. We simply desire at this point to invite attention to the closing chapter of the book and to Dr. Reinsch's letter to President Wilson tendering his resignation as American minister to China.

On page 382, Dr. Reinsch informs us that his resignation was tendered in the hope of enabling him to develop closer relations more effectively between China and the United States. "*I wished to bring about positive practical, action.* The spirit of the American policies and declarations was admirable, but not enough individual and specific American activity in China accompanied them." Now what was this positive practical action so much desired? In his letter of resignation dated June 7, 1919, after a violent indictment of Japan, he says "Since the complete breakdown of Germany the case of Japan has been carried through solely on bluff though perhaps it may be that the Japanese militarists have succeeded in convincing themselves that their establishment is formidable. *But it is plain that they would be absolutely powerless in the face of a stoppage of commerce and a navy demonstration on the part of any one of the great powers. No one desires to think of this contingency, but it is plain that after the breakdown of Germany it was not feasible for Japan to use force nor could she have suffered a greater damage than to exclude herself from the peace conference where she had everything to gain and nothing to lose. In ten years there may be a very different situation. Then also our people, having grown wise, will be sure to shout; 'Why was not this stopped while there was yet time?'*"

The story is outlined in the above undiplomatic words. Dr. Reinsch was advising the president to call Japan's bluff through a naval demonstration and a stoppage of commerce, which, for all practical purposes, amounts to a declaration of hostilities, and he sounds the keynote that has been repeated to me by all his co-workers. "*Now is the time;* now, before Japan grows stronger"; and if the president in his wisdom should fail to heed the warning, Dr. Reinsch tells him that in ten years, the nation will demand to know why it was not done sooner!

Dr. Reinsch was a quick worker. He was not so sure about the naval demonstration and hurried home to help along the cause of Armageddon. Although there is no direct proof that Dr. Reinsch advised the Chinese to boycott Japanese goods he did not advise against it, and there is proof that as soon as he placed foot in the United States, he urged in a press interview that Americans should hurry to China to skim off the cream of the Chinese trade while the boycott was on.

With the confessions of Dr. Reinsch before us it is not difficult to understand who was the master mind of the agitation to precipitate hostilities between Japan and America and it is easy to understand why, with this high example before them, the secretaries of American chambers of commerce in China, the Millard coterie, and others all worked in close unison with their chief. Never before in the history of such (movements) did such close team work prevail. From the time that Mr. Thomas F. Millard hurriedly departed from Paris in May, 1919, "to break the treaty in the senate," the anti-Japanese war-party lost no effort to precipitate hostilities, disguised under the thinly veiled hope that Japan was bluffing, that she would not fight. They refused to listen to any other method of settling these Oriental problems. America had the money and the guns; they wanted the latter pointed at Japan while we told her what to do in China and Siberia. In every way they brought pressure to bear on congress to intensify a situation they had been instrumental in creating. When Millard was solemnly warning the senate committee on foreign relations that the Shantung award at Paris meant war, quoting Mr. E. T. Williams, the chief Far Eastern adviser to the American delegation at Paris, Mr. J. B. Powell, his colleague, editor of *Millard's Review*, acting in his capacity as secretary of the American chamber of commerce in Shanghai was flooding the United States with circular letters calling upon firms interested in China to write to their congressmen and senators to demand from the state department the secret correspondence and memorandum that would disclose Japan's discrimination against American trade in Shantung and elsewhere, and have these documents read into the congressional records. An open incitement to hostilities. At the same time, the secretary of the American chamber of commerce at Tientsin was also sending out similar circular letters in which it was stated that only through armed intervention could China's sovereignty be preserved. Another open invitation for armed assistance to China. Nearly all of these so-called secret reports had been written during the war and there must have been a very close and intimate co-operation for their contents to be so widely known. It was a difficult situation, one that might well have led to most serious consequences, had not other far-sighted, conservative Americans got together to oppose the movement. There was every reason to believe that the war group with the reins of the situation in their hands would stop at nothing to hold their advantage.

We have no desire at present to reveal the depths of the underhand campaign employed by our political opponents to damage the prestige of this publication by the circulation of false reports, sufficient to say, however, that most of the proofs of the conspiracy is in our hands, the evidence all pointing conclusively to a tacit understanding that THE FAR EASTERN REVIEW was to be "put out of business." Chief amongst these reports was one that "The FAR EASTERN REVIEW had sold out to Japan," that it had received large sums to conduct Japanese propaganda, etc. These reports, from proof in our possession, emanated from the same sources that had previously circulated the story that THE FAR EASTERN REVIEW had been sold to the British, part of a deliberate attempt to destroy its usefulness amongst American manufacturers for the benefit of a competing magazine published in Shanghai, and edited by an American who acted as secretary to the American chamber of commerce. This, however, is a separate story, which will be brought before the American chamber of commerce at the proper time and place.

The policy of THE FAR EASTERN REVIEW has been aggressively American, reflecting the views of the most important interests in the United States as opposed to those Americans in China who insist that their opinions must be accepted as the basis of American policy in this part of the world. The views of the big business men in America were shared by their colleagues in Japan who stood opposed to the military policies of their own government and desired an honorable solution to existing problems so both nations could co-operate harmoniously for the reconstruction of China.

Both sides felt that the agitation for a "show down" could only end in hostilities, in which the greatest sufferer would be China. They held that only through frank conversation and exchange of views could a mutual understanding be arrived at. There were certain limitations that had to kept in mind. Japan would tolerate no interference with her rights in Manchuria gained as the result of two wars. She was willing to sacrifice all other advantages in China, but here she stood firm. There were angles to this situation that had to be explained so that Japan's case could be made clear. We have tried to place these facts before our readers, so that, in the event of a "show down," Americans would understand the other side of the case. The Washington conference was convened for the sole purpose of solving these problems, and it is gratifying to this publication to see that its policy all along the line had been fully vindicated.

We were the first paper in the Far East to point the necessity of a four-power pact to supersede the Anglo-Japanese alliance, and the first to call for a Pacific conference so that China's *full* case could be presented. The campaign of THE FAR EASTERN REVIEW for a better understanding through mutual concessions has been terminated. Our policy from now on is to contribute as far as possible to the reconstruction of China through international co-operation. We do not advocate that American firms in China should hand their business over to Japanese, but we do believe that China will be benefitted by a more friendly co-operation between American and Japanese capitalists, the first step in which is the success of the consortium, or, in the event of its dissolution, some other understanding that will permit the two nations to co-operate in China without friction.

Foreign Armed Forces in China

THE powers recently concluded a conference at Washington, in which, amongst other things, steps were initiated for the purpose of restoring, as soon as practicable, China's sovereignty, and to this end, all foreign troops are to be recalled. Yet as soon as it becomes evident that this decree is to be carried out the American chamber of commerce at Tientsin vigorously opposes the withdrawal of American troops from North China. "In view of the uncertainty of the political and military situation in China and the activities of large numbers of bandits," the chamber declares that the "withdrawal of the American troops at Tientsin would endanger the lives and property of Americans in China."

Now, if the property and lives of Americans in North China are endangered, the properties and lives of Americans in Shanghai, Hankow and other southern and Yangtze river ports are equally in danger. If there is a likelihood that the forces of Chang Tso-lin and Wu Pei-fu may come to grips in North China, the same possibility menaces Hankow as the forces of Sun Yat-sen move northwards and those of Wu Pei-fu attempt to check them. If Sun Yat-sen should make a diversion and send his troops down the river valley to Nanchang, with Nanking and the control of the Shanghai-Nanking and the Tientsin-Pukow railways as his objective, the lives and properties of Americans in Shanghai, Nanking and other ports will be endangered. There is just as much of an eventuality that internal disorders will break out in Central China as in the north, and American interests in the Yangtze should be equally as well protected. So, if the presence of an American regiment is essential to the peace of mind and security of Americans in Tientsin, two more regiments are necessary to insure equal tranquility amongst Americans in the Yangtze valley, to say nothing of Canton and South China.

American and foreign troops are in Tientsin in accordance with the terms of the Boxer Indemnity treaties, *for the sole purpose of keeping open the railway from Peking to the sea.* They are not there, as we understand it, to guarantee the lives and properties of American citizens in North China against the depredations of bandits or the dangers incidental to domestic strife. If the precedent established in 1900 for the sole protection of the legations is now to be extended to cover the uncertainties of internal politics and protect foreigners against the possible consequences of domestic warfare, then the principle must in all equity cover other parts of China where Americans have as much at stake as those residing in Tientsin.

The attitude of Americans in Tientsin is adequate proof of the hollowness and speciousness of past denunciations of Japan for maintaining troops in China for the protection of her nationals. Japan has a force stationed in Hankow, for what specific motive, we have never been able to fathom, but there is ample reason to believe they are there for the protection of Japanese merchants, their families and their properties, in which, it may be taken for granted, that their equity in the great Han Yeh Ping Steel Works is a vital consideration. The Japanese stationed troops in Shantung and in Chientao, they have entered Siberia and North Manchuria for the avowed purpose of insuring adequate protection to their nationals against the operations of bandits and other armed forces; they have gone further, and through the medium of the twenty-one demands extracted from China the privilege of establishing police boxes in various parts of Manchuria for the protection of the lives and properties of Japanese subjects against the depredations of the Hunghutzes.

Every such move has called forth the bitter denunciation of other foreigners. The American chamber of commerce of Tientsin, through its secretary, was responsible for a lengthy circular letter to firms at home which emphasized that, because of the presence of Japanese troops in Shantung, foreign armed assistance alone could restore the province to China. The shoe is now on the other foot. The American government has solemnly pledged itself to the full restoration of China's sovereignty, and to withdraw its troops as one of the first proofs of its sincerity, yet as soon as it appears that such a desirable example is to be set for other nations to follow, American residents in Tientsin are the first to protest.

We do not wish to be misunderstood. We believe there exists ample justification for the fears expressed by the American chamber of commerce of Tientsin. But it is equally true that the same menace confronts Americans in Hankow and the Yangtze valley ports, who have as much right to demand a regiment for their protection as Americans in the north. American troops are in Tientsin for the specific object of keeping open the railway from Peking to the sea. If they are to be retained there indefinitely for the protection of American lives and properties because of the uncertainty of the political and military situation and the activities of large number of bandits, the precedent is created for dispatching further American and other forces to other parts of China. The uncertainty of the political and military situation and bandit activities are chronic symptoms of the Chinese situation. If it is not Chang Tso-lin against Wu Pei-fu or Sun Yat-sen against the field, one tuchun or another in some other part of China is on the rampage. No section of China has been free from these disturbances for the past decade, and from all appearances, they have become normal and will continue so for some time to come. Let us then be honest with ourselves, with the other powers and with China. The plea of the American chamber of commerce of Tientsin, if acted upon by the American government, creates a principle that must be extended for the protection of Americans and other foreigners in other parts of China. The protest against the withdrawal of the American regiment at Tientsin is a frank admission that Japan has been justified, when, in the past, she has stationed troops in China to protect the lives and properties of her subjects. It would appear reasonable to believe that if foreign troops are still required to carry out the Boxer treaty provisions for safeguarding the railway from Peking to the sea, an aeroplane squal at Tientsin, would be just as efficient as an entire regiment. A few "crates of eggs" kept in cold storage to be judiciously dropped where they will do the most good at any time the line is menaced by contending forces, would prove more economical and persuasive in keeping it open, than a regiment of infantry acting as railway police. It would be difficult for the Chinese to repeat the mistakes of 1900. The installation of radio plants and the use of aircraft are an assurance against a repetition of the Manchu folly.

The powers at Washington have expressed their faith and hope in China and it is now up to her leaders to bring order out of chaos and demonstrate that they are worthy of the confidence reposed in them. The retention of an American regiment in China under the conditions set forth by the Tientsin chamber of commerce is not only provocative and a menace of further intervention, but a direct indorsement of policies that Americans have been the first to denounce.

China is entitled to every assistance in the difficult task of reorganization and unification that confronts her. The continued presence of foreign troops in North China is a standing invitation to ultimate intervention in her affairs, an obstacle to a proper solution of the admittedly uncertain political situation and an influence that can be utilized to advance or defeat the interests of opposing political factions. Whether Chang Tso-lin, Wu Pei-fu, Tuen Chi-jui, Sun Yat-sen, or any other factional leader gains the ascendency and controls the Peking-Mukden railway should be a matter of supreme indifference to other nations. It is China's railway, and whether it remains open to traffic or not should be equally indifferent to foreign governments. If the uncertainties of the internal political situation, the danger of civil warfare and the depredations of bandits threatens the uninterrupted operation of the line between Peking and the sea, the most sensible thing for the legations to do is to move to Tientsin or some other safe place. The only justification for the continuance of a large foreign force to insure uninterrupted communication between Peking and the sea would be in a recrudescence of the Boxer spirit and a possible seige of the legations. If we admit that this is impossible, then the continued presence of foreign armed forces in North China is an aggression upon the rights of China. The internal condition of China to-day is not peculiar. Other nations have gone through their periods of readjustment and civil war with its inevitable aftermath of banditry on a large scale. When conditions have become so bad in their capitals that communications with the outside world have been interrupted, the representatives of other nations have either moved their offices to the ports, or accepted the situation and taken their chances in the capitals of the governments to which they have been accredited.

If there is no danger of a repitition of the Boxer outbreak, then the continued presence of the armed forces of the powers in North China is contrary to the spirit which animated the deliberations of the Washington conference. Americans in North China have no more right to expect that a regiment should be stationed at Tientsin, than Americans in Shanghai, Hankow, Canton and other parts of China have to demand similar forces to insure their safe access to the ports in the event of internal troubles. If an American regiment remains in Tientsin, we must be prepared at any time to witness another invasion of China by foreign armies. For, it goes without saying, that other powers, in the event of trouble, will insist on sending as strong a force into North China as may be maintained by Americans, in order that the latter may gain no undue advantage.

If a large American force is maintained in North China to see that China gets a square deal in the event of future trouble and to offset advantages that might be obtained by another power whose forces might be numerically greater, then let us also be frank about it so the American tax payer will understand why he is called upon to pay this extra burden. Whatever force such an argument may have had in the past, has been vitiated by the Washington conference. If the time ever arrives when armed intervention in Chinese affairs becomes necessary, there are sufficient troops six days away in Hongkong, Manila, Indo-China and Japan to handle the situation. The continued presence of the American troops in Tientsin is opposed to the best interests of both China and the United States.

Owing to the disturbed and uncertain political conditions in China, with Canton proclaiming the illegality of the Peking president and cabinet, maintained in power largely through the recognition of foreign governments, the presence of foreign troops in North China gives an undue advantage to Peking as against the claims of Canton. Their presence, therefore, constitutes a direct intervention in the internal affairs of China, and materially strengthens the arguments of Sun Yat-sen and the southern government. Take the foreign troops away from North China, and if the legation staffs and foreigners resident in Peking are reluctant to take their chances in the event of disturbances in the capital, let them remove to Tientsin or some other safe place, and permit the Chinese to settle their own affairs in their own way. As long as the legations remain safely in Peking protected by their guards with an American regiment keeping open the railway line to the sea, so long will a settlement of China's internal difficulties be delayed. Once these troops are withdrawn, and foreigners resident in Peking provide proof of their fears by removing to Tientsin, the prestige of the Peking government will wane and a way soon found for the long delayed unification between North and South.

It is natural to suppose that the legations and foreigners resident in Peking will be extremely loath to entertain any proposition that might disturb their repose, and that many excellent arguments will be presented in order to keep American troops in North China. But if this is to be done, let the facts be clearly understood. Let us be consistent. If the presence of an American regiment in North China is deemed necessary for the protection of American lives and properties growing out of the uncertainty of the political and military situation and the activities of bandits, American residents in Hankow and Shanghai have the undoubted right to demand similar protection, and because of the same perturbed conditions existing in northern Manchuria, Japanese residents in Harbin have the same right to demand a regiment or so for their protection against the Hunghutzes and the Red armies of Lenin. Keep the American troops in North China if conditions so warrant, but let Americans forever after close their mouths about the presence of Japanese troops in parts of China where the lives and properties of Japanese are exposed to the uncertainties of the military and political situation and bandit activities.

GEO. BRONSON REA.

China's Mineral Resources

IS it not about time that a stop be put to propaganda about China's unlimited mineral resources, and face the truth ? For many years the world has been told of the Klondike-like opportunities existing in the development of China's mineral resources until it has become accepted as a fact. As a result of this campaign, many mining engineers and prospectors have been lured to China in the hope of striking it rich, and have departed very much out of pocket and disgusted with the prospects. A sample of this propaganda is seen in a recent statement by Roger W. Babson, the famous American economist, in which he says :

> " China to-day has the greatest natural resources in the world. The greatest virgin deposits of coal, iron and copper are in China. It possesses great undeveloped water powers, wonderful fertile valleys, and great primeval forests. By nature it is the richest country in the world. But unlike South America, which is also rich in natural resources, China has a great and industrious population. The largest available labor supply in the world can be found there to-day."

Such broad unqualified statements can result in no permanent benefit to China, for investigation only proves their fallacy. The great undeveloped water-powers exist perhaps in the Far western provinces, but it will many, many, years before they can be made available to turn the wheels of industry. As to great primeval forests the same statement holds good. Such forests as China possesses are so far from transportation, that it will take another decade or so of railway construction before their timbers can reach a market. As to the virgin deposits of coal, iron, copper and other minerals, it is better to listen to what mining experts have to say on this subject.

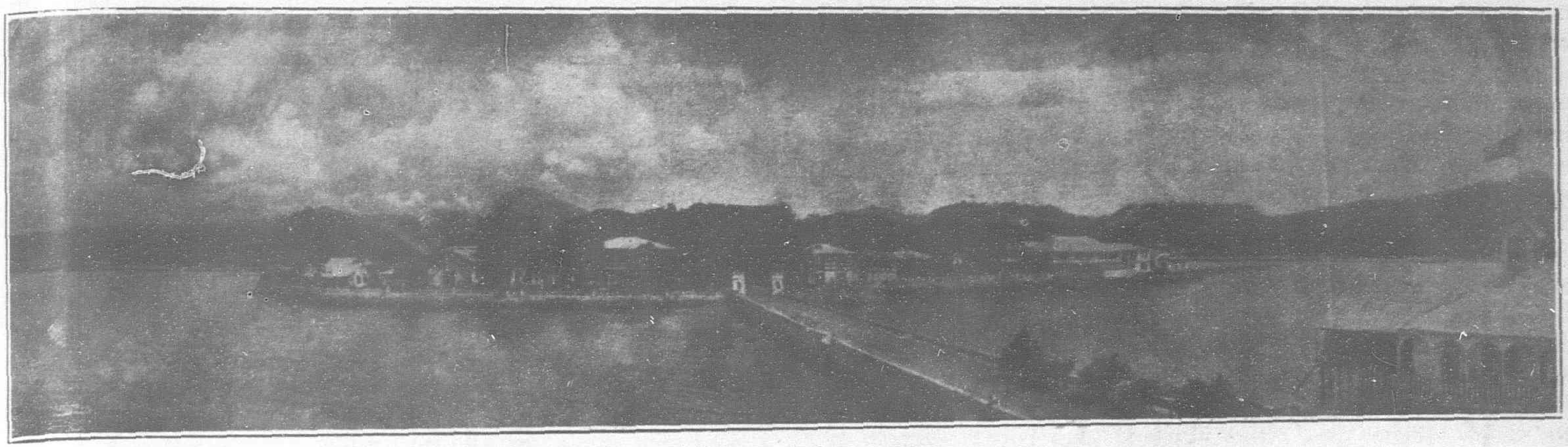
The foremost mining expert of the United States, H. Foster Bain, director of the bureau of mines, expressed himself as follows before the Engineer's Club of Philadelphia :

> "The field for the American mining engineer in China, is limited. Notions of great mineral wealth in that country have persisted even since the time of Marco Polo, but they are exaggerated. Some coal of an excellent quality is found, but there is no reason to suppose there are any large quantities of iron ore. One company in China produces about 150 tons of steel annually, although market problems make the situation somewhat involved. What is true of steel is true also of lead, copper, silver and some other ores.
>
> "It is possible a future Klondike may be found in China, but political disturbances interfere with development and the gold is in a region infested by bandits. The largest antimony deposits in the world are in China and, if these are properly developed, that country is capable of controlling the world's supply.
>
> "The future of mining development in China will remain with Chinese engineers, although there is a field there for foreign engineers to make examinations and reports."

This statement is entirely in line with a similar one made by the British commercial attaché at Peking in his 1920 report on the trade of China. The mining possibilities of China have been greatly exaggerated. The concensus of export opinion after careful investigation is unanimous on this point.

Undoubtedly much remains to be done in the development of China's mineral resources and every assistance should be extended to the Chinese in their exploitation, but the great expectations that foreign capital will control this industry should be discouraged until the Chinese show some disposition to remodel their laws and permit foreigners to direct their investments in this field of industry. This disposition, however, is slow in manifesting itself. On the contrary, the tendency is to develop the mining resources of the country by native capital, which is amply attested to by the number of mining permits issued by the government at Peking and the increasing demand for mining machinery from these native concerns. The *Mining Journal* of London, in commenting on the survey of the industry as presented at a recent dinner of the China institute of mining and metallurgy, says :

" One of the most important directions in which China will be influenced by the possibility of modern industrialization will be in connection with the mineral industry. There is apparent a considerable amount of parallelism between the position in China and in India. In either case there are vast populations offering an abundance of cheap, if unskilled, labor, and untapped markets for an immense variety of things which have become necessities of life in other countries, and which the Chinese have shown every desire to acquire when the means are placed within their reach. In both cases the leading mining possibilities are in connection with coal and iron and the industries which subsist upon this combination. A country which is already producing between 20 and 25 million tons of coal and some 2 million tons of iron ore is worthy of attention ; and where China differs from so many of the newer fields of mining and industrial enterprise is that no limit can be set to the extent of development of future years such as is suggested by an examination of colonial fields where the productive and consuming power of the individual is already perhaps rated more highly than in the great industrial centres of Europe. Steady progress is already being made in the organization of a mining administration, and it would seem, at any rate, as though the officials were endeavoring to work on lines approved in the big mining countries of the West. Very possibly these efforts are still somewhat academic and have not taken any real root in the life of the Chinese, but when a start does take place in China, progress is often rapid. China, to-day, governs the wolfram industry and, to a large extent, antimony also. Chinese policy of late has dictated that mining and associated enterprises shall be, in part, national in consitution, and on account of the local complexion of such enterprises we hear less of the development of which is going on than if the work was undertaken by companies registered in this country. The development of the mining industry in Japan, since the Chino-Japanese war, has been extraordinary. If Japan, with a population of 45 millions, can do so much, the potentialities of the mineral industry in China are difficult to compute.



The Old Town of Jolo, capital of the Sultan of Sulu

The Sulu Archipelago

Its Natural Resources and Opportunities for Development

By P. J. Wester, Agricultural Advisor

THE Sulu Archipelago is a group of islands located between 119° and 122° east longitude and between 4° and 7° north latitude, extending in a southwesterly direction from Basilan to Borneo, bounded by the Sulu Sea on the north and the Celebes Sea on the south and east. The entire length of the archipelago is approximately 137 miles, and it includes about 130 fairly large islands, most of which are inhabited, and some 170 islets and reefs chiefly of geographical interest. The Sulu archipelago has an estimated area of 1,030 square miles and a population of 156,212 inhabitants according to the census of 1919. All the larger islands in the Sulu archipelago are of volcanic origin, and their location and the topography of the sea bottom suggests that they may have been the connecting link of a continent extending from Mindanao, the Visayas and Luzon in the northeast, to Borneo in the southwest.

The Sulu archipelago is usually considered in two large groups, the Jolo group and the Tawitawi group. These two agglomerations are again divided into 13 small groups, is as follows:

The Samales group; the Jolo group (Jolo is the largest island in the archipelago; and here Jolo, the provincial capital, is located); The Pangutaran group; the South Jolo group; the Tapul group; the Kinapusan group; the Tabuan group; the Tawitawi group; the Sigboye group; the Tataan group; the Sibutu group; the Pearl Bank group and Cagayan de Sulu group.

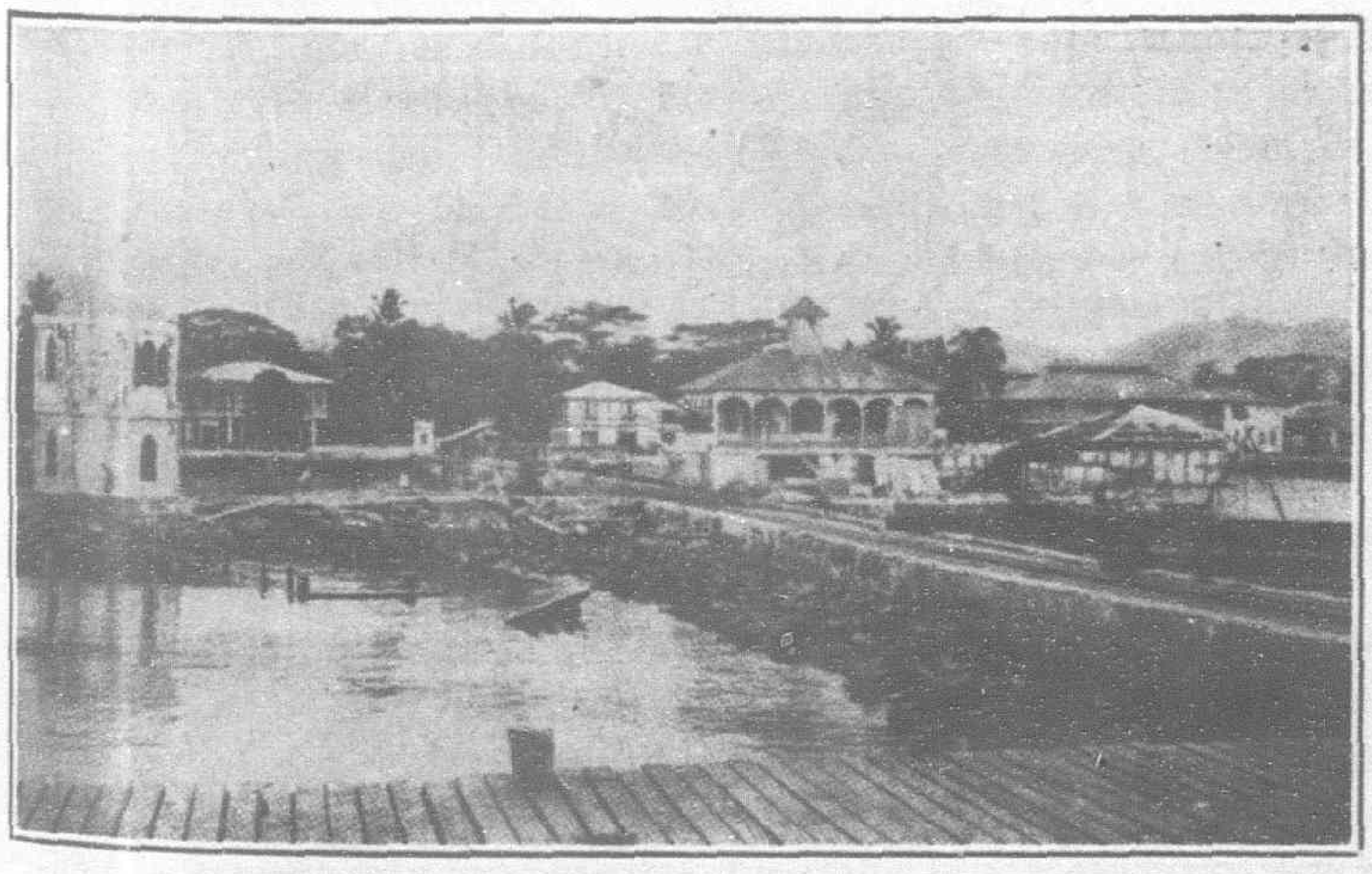
The majority of the smaller islands and reefs are coraline and the approach to many of these is very dangerous and difficult because of the shallow water and the narrow, tortuous channels between the reefs.

Among the islands worthy of more than passing mention: Bakungan is a precipitous, densely wooded island about one mile long and half as wide, located about 11 miles east of Jolo. The inhabitants are occupied principally in fishing.

Bongao is a small, rocky island off Sanga-sanga, with good anchorage. The precipitous mountain of the same name is about 340 meters high and a striking landmark from a great distance. Farming and fishing are the principal occupations of the people. The town has a small dock approachable by a good-sized launch.

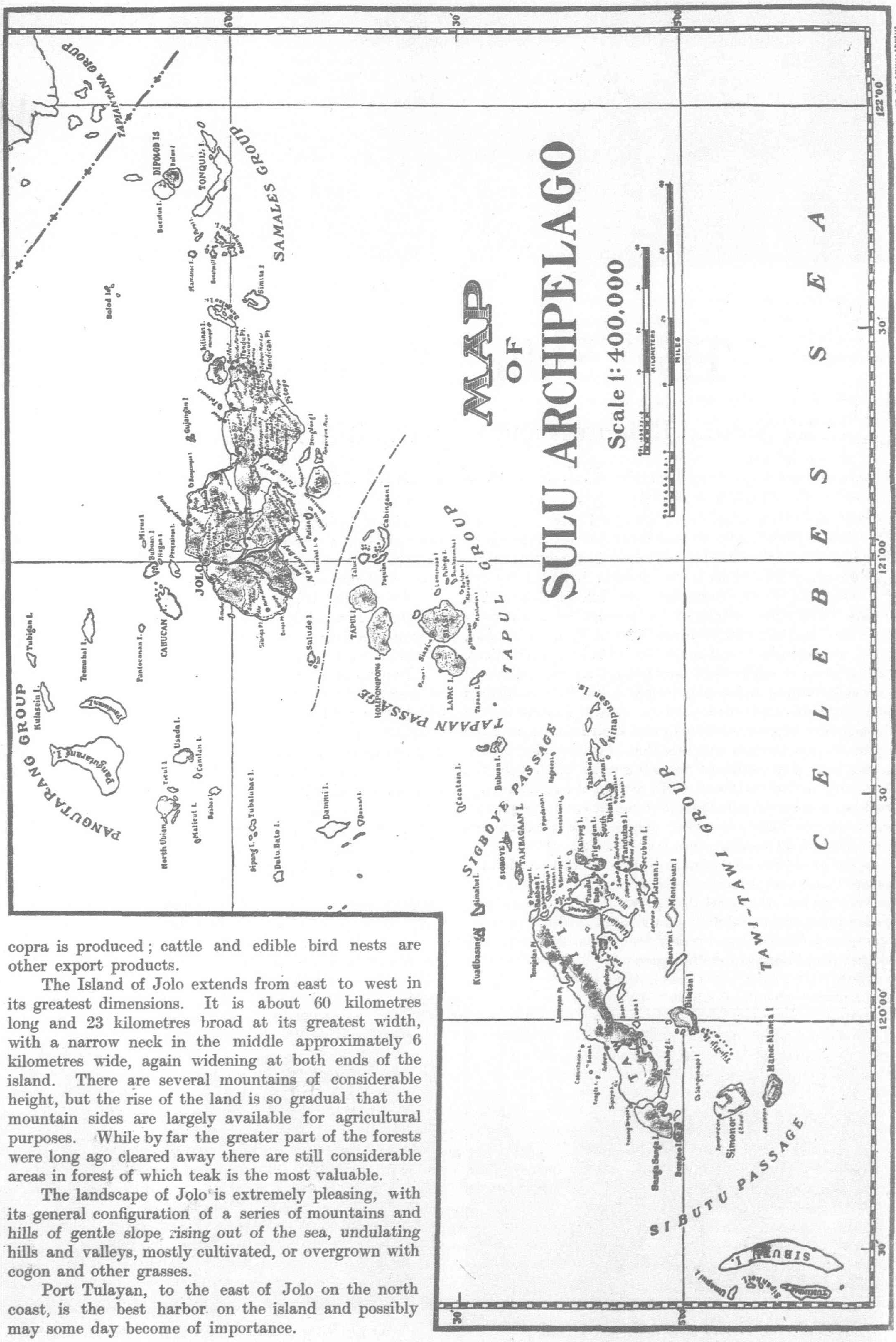
The little Island of Buan, located about midway of Tawitawi on the south side is difficult of access and can be approached only by small motor boats and vintas. It is mentioned because of its numerous springs from which water is obtained by the inhabitants on the neighboring islands. The principal occupations of the population are fishing and farming.

Cagayan de Sulu is about 8 miles long and 5 miles wide, and well elevated above the sea, culminating in a mountain 330 meters high. The island has two small, deep lakes near the south coast and many springs with excellent drinking water. The anchorage at the dock is very good. The island is very fertile and considerable



A view of the Town of Jolo from the Landing Stage

Old City Gate to Jolo as viewed from the Landing Stage



copra is produced; cattle and edible bird nests are other export products.

The Island of Jolo extends from east to west in its greatest dimensions. It is about 60 kilometres long and 23 kilometres broad at its greatest width, with a narrow neck in the middle approximately 6 kilometres wide, again widening at both ends of the island. There are several mountains of considerable height, but the rise of the land is so gradual that the mountain sides are largely available for agricultural purposes. While by far the greater part of the forests were long ago cleared away there are still considerable areas in forest of which teak is the most valuable.

The landscape of Jolo is extremely pleasing, with its general configuration of a series of mountains and hills of gentle slope rising out of the sea, undulating hills and valleys, mostly cultivated, or overgrown with cogon and other grasses.

Port Tulayan, to the east of Jolo on the north coast, is the best harbor on the island and possibly may some day become of importance.

Jolo, the provincial capital of the Sulu archipelago, is located on a wide bay on the north side on the western end of the island. The city is connected with Zamboanga by cable, and has a local telephone system reaching out to several of the more important island villages. The road system on Jolo is rather incomplete, though one may reach Maibung, Parang, Indanan and Camp Romandier by auto.

The *Islas Filipinas* calls from Manila and Zamboanga twice monthly and there are monthly steamers between Singapore, Sandakan, Borneo and Zamboanga which call at Jolo in passing that port each way. Various smaller craft maintain additional communication with Zamboanga and the Sulu island ports of Siasi, Bongao, Sitanki and Cagayan de Sulu, where there are small docks.

Laminusa is a small, low coral island about a mile long largely covered with mangroves. It has a good anchorage but poor water, and is mentioned chiefly because of its pearl and trepang fisheries. Excellent mats are made and exported from Laminusa.

Laparan is a low coral island some seven miles long, in the interior of which is a large lagoon about three miles long. The island has no water and is uninhabited.

A Road in Jolo

Lapak is located across the narrow channel from Siasi and has good anchorage on the north and south coasts. The water, obtained partly from springs and partly from wells, is good. Farming and fishing are the principal occupations of the people. Some copra is exported. Lapak is nearly five miles long and three miles wide, with two mountains at the opposite ends of the island, the one in the north 300 and the one in the south 450 metres high, with a wide plain of good to excellent agricultural land in the middle, practically all uncultivated and overgrown with cogon. Attempts have been made by American planters to grow rubber and cassava on this island but all of them have failed.

Lugus is about four and a half miles long and three miles wide, with a good anchorage on the northern and the west coasts. The land formation is a series of fertile hills rising to one peak about 290 metres in height. There are two small lakes on the island but the drinking water is poor and brackish. The population subsists by farming and fishing, the island being quite well cultivated. Copra is the principal export article.

Mantabuan is a small, flat, quite populous island to the south of Tawitawi, with a good anchorage in the channel between it and Latuan island. The population is occupied principally in fishing. Some trepang and shells are exported.

The little Island of Manubul, located a little way from Lapak to the southwest is one of the fishing centres of the Sulu archipelago, exporting dried fish, shark fins and trepang. The anchorage is good but there is no drinking water on the island.

Manukmankau is a flat coral island about two miles wide and twice as long lying a little to the south of Simunul. The anchorage is poor. The drinking water is of fair quality and is obtained from a small pond in the centre of the island. The people are occupied principally in farming, especially in growing a tobacco which by the Sulus is preferred to all other kinds. Some rattan mats and pottery are also made for export.

Pangutaran is a low, flat coral island some 10 miles long with good anchorage, but having very poor drinking water. Farming is the principal occupation of the inhabitants who export copra and cattle.

Panducan is a low coral island, some 6 miles long and about 2 miles wide, located about 23 miles northwest of Jolo. The people are occupied chiefly in farming. Copra, cattle and mats form the articles of exports. The anchorage is good on the south coast. The drinking water is very poor.

Pata is an almost circular island of volcanic origin about four and a half miles in diameter with a mountain in the centre some 330 metres in height. Pata has a good anchorage and good drinking water from springs. The island is well elevated above the sea, the soil is fertile, and most of the land is under cultivation. Copra and cattle are exported.

Sangasanga is an island about 6 miles long located between Tawitawi and Bongao, the population of which are occupied chiefly in farming.

Secubun is a small, low flat coral island with poor and brackish water, the inhabitants of which support themselves by farming and fishing. Dried fish, trepang, pearl and tortoise shells and copra are exported from Secubun.

Sibutu is a long, narrow island some 16 miles long and perhaps 4 miles at its greatest width, lying southwest of Bongao and only about 25 miles from Borneo. The island is partly of volcanic origin, partly coralline. The people are occupied chiefly in farming and cattle raising though some dried fish and trepang are exported. The cutting of railroad ties is the principal industry.

Simunul is a flat rocky island south of Bongao about eight kilometres in diameter. There is no good anchorage off this island and the water is good, being obtained from springs in the centre of the island. The exports are principally pearls, shells and trepang. Wild hogs are quite numerous and there are many wild carabaos descended from escaped domestic animals, most of the island being tilled. Chongos Bay on the southeast coast is a good harbor.

Siasi is an almost circular island of volcanic origin some 10 miles in diameter located 37 miles southwest of Jolo, and is the third most important island in the Sulu archipelago. There is a gradual and even slope of the land from the sea to the top ofMount Gorra in the centre, attaining a height of 400 metres. The soil is fertile and the land is largely cultivated up to the mountain top or overgrown with cogon. The town of Siasi has a good anchorage and is equipped with a water system. The water, which is excellent, is obtained from springs on the higher slopes of the island. The inhabitants are occupied chiefly by farming and fishing, and copra, abacá, cattle, dried fish, shark fins, trepang, pearls and shells form the export products.

There is a small ceara rubber and robusta coffee plantation in Siasi owned by an American corporation. Local industries include mats, pottery and shell bracelets.

Sitanki is a small island and seaport southwest of Bongao and west of the south end of Sibutu with a good anchorage, but all drinking water is obtained from Sibutu. Some dried fish, trepang and shark fins are exported.

South Ubian is a small, low and flat coral island about 64 miles southwest of Jolo with a good anchorage, but having very poor, brackish water. South Ubian is one of the most thickly populated islands in the archipelago and is well cultivated. Pearls and shells and trepang are exported from South Ubian.

Tandubas is a small island southeast of the east end of Tawitawi. Agriculturally the island is of no importance but it is quite populous, the inhabitants being occupied with fishing. Pearls and shells and trepang form the chief exports. The anchorage is good on the east coast of the island opposite the town of Ungas Matata. The drinking water is poor and brackish.

Tapul is an island of volcanic origin and with a good anchorage, located about 25 miles southwest of Jolo, the highest peak rising to an elevation of 500 metres. The island is nearly circular and about eight miles across, with springs in the interior that provide good drinking water. The greater part of the island is under cultivation and it is considered as one of the most prosperous in the archipelago. Excellent mandarins are produced. The exports include coconuts, hemp, citrus fruits, pearls and shells, trepang and dried fish, and some cattle and horses.

Tawitawi is the second largest island in the Sulu archipelago, being some 35 miles long and 13 miles broad at its greatest width. Unlike Jolo, Tapul, Siasi and Lugus, which are well adapted for agricultural purposes, the topography of Tawitawi is very broken, rough and mountainous with a range of mountains extending throughout its entire length of which several peaks rise at 300 metres or more, one, the Bihabiha, attaining a height of 580 metres. Several small rivers or, more correctly speaking, streams, find their way from the interior to the sea; of these the Dungun and Malum Rivers are the largest in the Sulu archipelago. The anchorage on the north coast is good, which is also true on the south coast as far as the town of Balimbing. Drinking water is good and plentiful. Nearly the whole island is covered with dense forest which as yet is largely unexplored. Some railroad ties are being cut and shipped out of the island, but because of its mountainous character Tawitawi will never attain any importance agriculturally.

Tonquil is a narrow, crescent-shaped, flat coral island about 10 miles long located south of Basilan and east of Jolo, with a good anchorage but poor, brackish water. A large part of the island is covered by mangrove. The exports include dried fish, trepang, pearls, shells and copra.

To the traveler with a love and appreciation of scenic beauty, picturesque surroundings and a study of the primitive, simple life, sufficiently spiced with danger to render the experience more fascinating than an ordinary outing, a cruise through the Sulu Sea is certainly to be recommended.

Next to Jolo, Siasi is the most important trading centre in Sulu. The anchorage is good and the channel between Lapak furnishes a reasonably safe harbor. The soil is fertile. Also, a large part of the island is under cultivation.

Climate

The climate of Sulu is mild without violent changes in temperature. The nights are always cool.

The rainfall is plentiful and equally distributed throughout the year.

Population

The population of Sulu, numbering 156,212 souls, is greater than that of any province in the department of Mindanao and Sulu, though in area it is smaller.

Tribally the population may be divided into three groups. The Sulus are the most advanced of the native inhabitants, who, before the advent of the Spaniard and American, were the ruling people of Jolo. The Sulus constitute the agricultural population of the archipelago and from them are largely recruited the labor employed in cutting railroad ties, the one industry in Sulu in which Americans are engaged. They are also engaged in fishing and pearling.

The Samals are, together with the Bajaos, in the majority on the smaller islands and on the coasts of Jolo. Both make their living from the sea, and while the Samals are somewhat more advanced in civilization than the Bajaos, there is really very little difference between the two tribes. The agriculture engaged in by the Samals is of the crudest form, while the Bajaos prefer the sea altogether. The Filipinos in Sulu are very few and of the white race there are still fewer representatives. The Chinese trader in Jolo, Siasi, Bongao and Sitanki one may not escape any more than in any other trade centre in the Philippines. He is the almost indispensable link between the farmer and fisherman and the export houses in the centres of trade in the Philippines.

Agricultural Industries and Food Crops

The agricultural practices in Sulu do not differ materially from those in the other regions in the Philippines, and production per unit area could be greatly increased by more modern methods of culture.

Abacá, the principal product of Sulu, is grown chiefly on the island of Jolo; the quantity of fiber produced on the other islands is negligible. Soil and climate both are well adapted to abacá over a large area of Jolo island and the area planted could be increased very considerably, especially in the interior. However, the extension of the abacá plantations may well be left to take care of itself. The more urgent measures are the education of the Moro farmer in the need of more thorough preparation of the land before planting, better cultivation and instructions in stripping and grading of the fiber.

Copra constitutes the second largest export article of Sulu but it will unquestionably supersede abacá within the next few years. Most of the copra is probably produced on Jolo island though there are few inhabited islands where coconuts have not been planted. On the outlying islands the largest number of coconut trees are found on Tonquil, Pangutaran, Bangalao and South Ubian. However, the nuts are, to a great extent, consumed as food in the localities where they are grown. In systematic planting and care of his trees the Moro appears to be behind the Filipino planter in the Visayas and Luzon, in fact, it is doubtful whether there are any, even small plantations, regularly spaced or otherwise properly cared for, and there is a crying need for far advisers to set the people right in these respects. This is equally true in regard to control measures for beetles and weevils. To no other crop are the numerous coral islands so well adapted as to coconuts and too much could not be done to encourage the extension of coconut plantations on these islands.

Cattle raising is another industry that goes well in hand with coconuts on the larger islands where good water is available. It is especially worthy of attention considering the isolation of the islands and the ease with which diseases can be kept out of this region.

From the export figures, it might be inferred that rice beyond the needs of the population was produced, whereas the rice imports rose to P.900,000 worth in 1918. Several varieties of upland and lowland rice are grown, upland rice predominating. Most of the rice is grown in Jolo.

In 1918, there were 20 small sugar mills in operation in Jolo but these of course were all of a very primitive type and the quantity of sugar produced was insignificant. Considering how well adapted to coconuts, coffee, rubber and abacá Jolo Island is, and how well occupied the land in small holdings by the present population, there does not appear to be much room for a sugar industry and it is probable that land now planted to sugar cane could be far more profitably occupied by other crops.

Corn is not of especially great importance as a food crop in Sulu. Cassava is very extensively grown, there being possibly a greater area planted to cassava than to any other single crop. Camotes, ubi and gabi are also grown to some extent. Other crops of less importance are borona, sesame and adlay.

The more popular vegetables include patani, squash, patolas, pepinos, tomatoes, watermelons, chili and kankong. Sago is made from the sago palm.

Fruits

Jolo is noted for its many fruits, and the climate and soil are very favorable for fruit culture. Mangosteens, baunos, marangs, huanis, durians and rambutans, unobtainable nearly every where else in the Philippines, are abundant in Jolo, in addition to many other fruits, such as the lanzon, bulala, papaya, banana, jak, etc.

Forest and Forest Products

At present there is only one sawmill in operation in Sulu; it is located in Jolo.

Properly developed the forest products of Sulu should become a very important source of revenue. Public commercial forests are located on Tawitawi, Sibutu, Sangasanga, Simunul, Manukmankau, Lintian, Tandubatu, Basbas, Tata, Ampoy and Tabulunga. These forests contain much the same timbers as the forests in other parts of the islands, both hard and soft wood, such as: ipil, *intsia bijuga*, *pahudia rhomboida* and *adenanthera intermedia*; yakal, *hopea* spp., *isoptera borneensis*, and *shorea balangeran*; calantas, *toona calantas* and *azadirachta integrifoliola*; lumbayao, *tarrietia javanica*; guijo, *shorea guiso*; narra, *pterocarpus indicus* and molave, *vitex parviflora* and *V. pubescens*.

The only commercial teak forest in the Philippines is located in Jolo, being some 2,500 hectares in area. This is now being logged by the province on a small scale. The most important forest product is railroad ties. Almaciga formerly was collected in considerable quantities but production dropped off to a negligible quantity during the past year. Gutta-percha and gambier have never been collected in appreciable quantities. Some tanbark is obtained and this is an industry that could be increased very considerably. Some lumbang nuts are collected and exported. The archipelago produces a small quantity of cinnamon. These minor products will never attain much importance, but lumbering, the cutting of railway ties and the collection of tanbark are capable of development into industries of considerable magnitude.

Mining

There are no mining operations in progress anywhere, though manganese has been discovered on various islands and gold has been found in Jolo. Oil has been reported from Siasi but no attempt has been made to make borings. It is quite possible that the manganese deposits are large enough to be worth investigating considering that, according to analyses made by the bureau of science, the ore contains 62 per cent. pure manganese.

Marine Industries

Pearls, pearl shells, tortoise shells, fresh and dried fish, trepang and shark fins constitute the marine products of Sulu.

The shark fin industry has been of steady growth, but no effort has been made to make oil from the shark livers and guano from the sharks themselves. Diving and fishing for pearls and shells is one of the most important industries in the Sulu archipelago which produces most of the shells and pearls for export from the Philippines. Moros as well as Japanese and Chinese are engaged in this work.

There are many sponge beds in the Sulu archipelago and several attempts have been made to engage in sponge fishing, which, however, has been abandoned within the last three years. The sponges are reputed to be of good quality. Failure to cure them properly is said to have caused their arrival in the United States in bad order.

Trepang fishing could undoubtedly be engaged in on a far greater scale than at present, which is probably also true of tortoise catching. It is of interest to know that young tortoises are frequently caught and kept in captivity for several years before they are killed. One of the curious sea products of Sulu is the so-called "sea horse," a small animal with head and neck like a miniature horse, which is dried and exported to China because of its supposed medical value.

Prospective Industries

With few exceptions the development of the industries of the Sulu archipelago would appear to lie in the hands of the present inhabitants, and opportunities for investment by big capital are not many. There is unquestionably much timber, especially in Tawitawi, but the broken topography of that island would probably make transportation of logs from the interior to the sea more difficult and expensive than in other parts of the Philippines. Railroad ties can be brought out more readily, and this industry may be expected to expand during the next few years. Considerable teak may be expected in the market from the government reservation but owing to the small area of this forest no very great output can be anticipated for more than a short period. Whether the pearl beds are so extensive that a larger pearling fleet could find profitable work is doubtful. On the other hand it would appear that a well organized sponging outfit, prepared to properly care for the harvested material and place it on the market would be profitable. The value of the pearl and sponge fisheries might be greatly enhanced by the judicious planting of new beds.

As the shark fin industry grows there would appear to be room for a small guano factory to take care of the shark meat and to prepare the oil from the livers that is practically a total loss at present. It is not generally known that shark liver oil is very similar to, and can be used for, all the purposes for which cod-liver oil serves.

Broadly speaking, the great agricultural export crops of Sulu will always be copra or coconut oil and abacá. The plantations will be small and probably always remain in the hands of the Moros. There is not sufficient public land available at any one point to induce the American and European with his heavy overhead expenses to engage in coconut growing in this part of the world, considering how much more favorable for plantation ventures all conditions are in Mindanao and Basilan. The same, is, of course, true of para rubber. Coffee is well adapted to native culture and on Jolo there are numerous streams that could be utilized in preparing the coffee, so that there is no reason why, with the adoption of a more diversified system of farming by the Moros, coffee should not become a crop of some importance. In some sections there is excellent tobacco land.

Much land within a radius of eight kilometres of Jolo that is too shallow for other crops could, to advantage, be planted to pineapples, and a cannery in Jolo would be at the same time within easy reach of the plantation and of the wharf, and it might in part be employed for canning fish.

In fine, a region of unsurpassed scenic beauty and romantic interest, inhabited by a virile race of picturesque, interesting people, the Sulu archipelago, with an older authentic history than any other part of the Philippines, is of unusual interest to the traveler and tourist. Already quite densely populated, Sulu offers but little inducement to the investment of big capital, especially along agricultural lines, and apparently is destined to be developed chiefly by her sturdy native inhabitants.

ERRATUM

Mr. Oei Tjoe

On page 147 of the March issue lines 32 and 33 should read:—

A native of Amoy, he went to Java to learn the sugar business, and in the course of time invested his earnings in sugar properties.

Russian Timber Industry

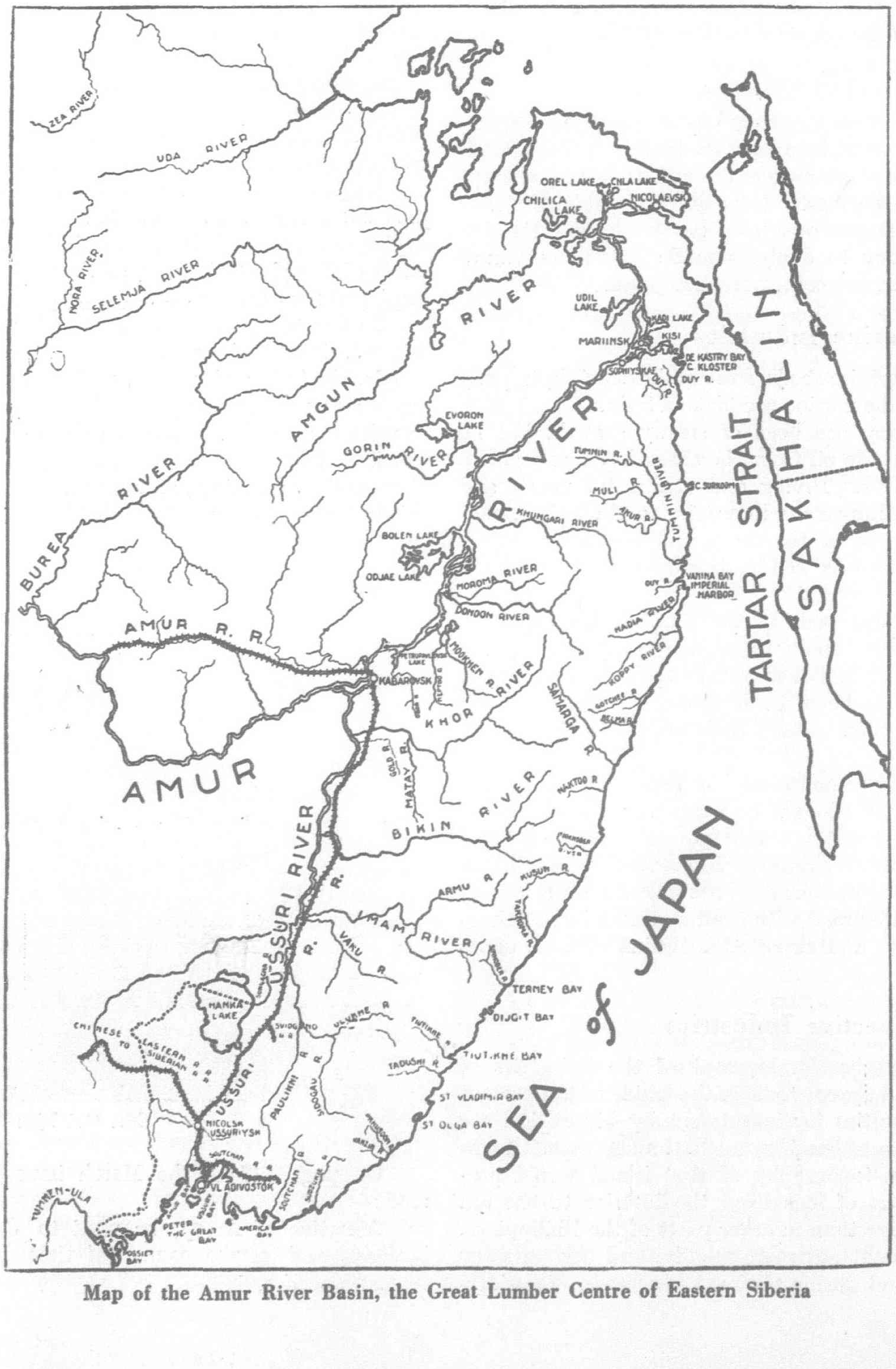
By W. Jacob in "The Timberman"

IN the month of July the working year of the chief timber committee came to a close. The operations of the committee had been carried through under most difficult conditions and discouraging circumstances. The months of January and February were characterized by a fuel crisis; when it became necessary to rely on the removal of timber in order to maintain traffic on the railways, and to slow down the preparation of timber, which of course produced its effect of later operations in respect to a reduced removal of goods in March and April. On the other hand the severe crisis in provisions was keenly felt throughout all the operations of the chief timber committee and its local organizations.

To these leading factors that interfered with the success of operations during the working year 1920 1921 must be added a purely meteorological factor resulting in the low level of the river waters through the absence of rain, which made floating difficult, and reduced both the period of time and the geographical limits within which it could be done; for on a great number of small rivers on which under ordinary conditions timber could be floated in the spring time, such could not be done last spring. All these factors influenced the issue of the timber operations discouragingly, reducing the quantity prepared and consumed. Only with incredible exertion and close organization both on the part of the chief timber committee and its local organizations, accompanied by the development of every energy and initiative was the timber business, closed in the working year named, more or less satisfactorily, to the extent of 70 per cent. of the program that had been marked out.

According to data, not altogether complete, affecting the preparation campaign 1920-1921, the quantity of firewood prepared was 9,500,000 cubic sagens (one cubic sagen equals 343 cubic feet) and the quantity removed was eight million cubic sagens; and the quantity of industrial timber prepared was two million cubic sagens and the quantity removed 1,200,000 cubic sagens. Thus the total quantity of timber prepared in some form or other was 11,500,000 cubic sagens and the quantity removed was 9,200,000 cubic sagens.

Such is the result of the timber industry in the preparation of and provision of fuel and timber materials required. In the wood-working industries there were 1,100 factories engaged, running 1,900 frames; and 550 factories with 980 frames were idle. The product of work done in the sawmills during the past working period, from October 1, 1920, to May 1, 1921, according to the reports of 37 local organizations (the others not having supplied full particulars), was 42,840,000 cubic feet. But taking the whole yield for the period as 46,500,000 cubic feet, which is believed to be correct, the program marked out for these mills was exceeded by 8.5 per cent.; that is that the total production amounted to 108.5 per cent. of the quantity required of them by the chief timber committee.



Map of the Amur River Basin, the Great Lumber Centre of Eastern Siberia

Export Situation Becoming Normal

The export operations during the working year under review were most effectively carried out on the western Dwina, at Riga, to where 165,000 logs were directed. The export of sawn timber is gradually becoming regular, and at the present moment in the neighborhood of Petrograd there are about 300,000 standards of export timber. Recently the Soviet foreign export committee has been actively engaged arranging for the shipment of this timber.

The timber program for 1921-22 is closely governed by these results as attained in the past working year, and the resources that may be anticipated for the current year.

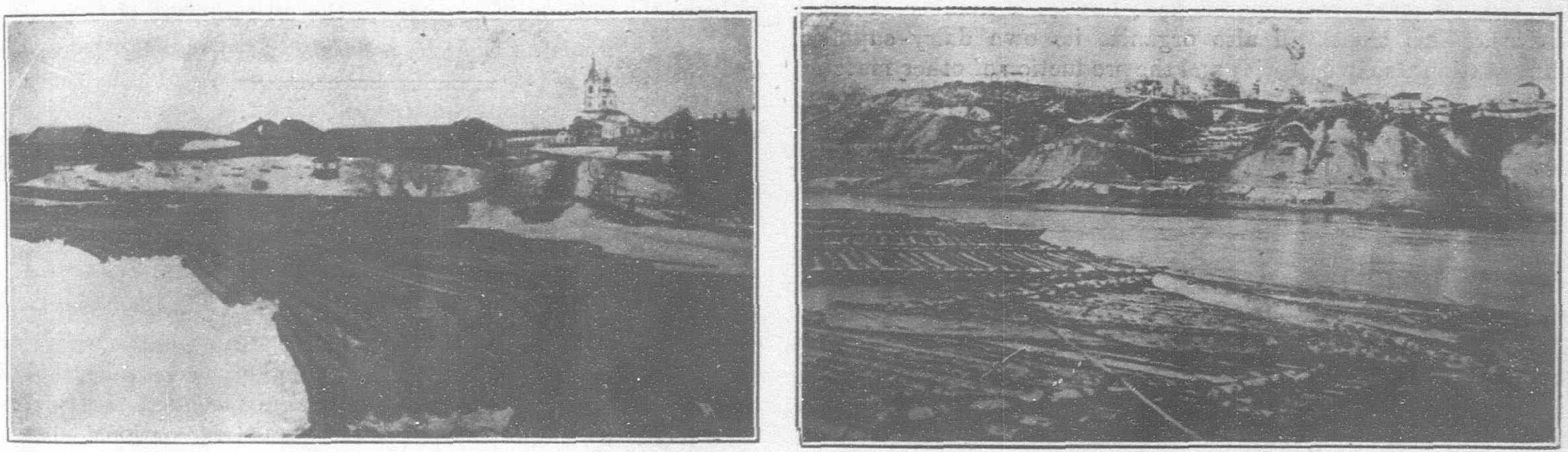
Thus it is proposed to prepare and remove for government requirements, firewood, etc., to the extent of 10,500,000 cubic sagens, and industrial timber to the extent of three million cubic sagens, or a total of 13,500,000 cubic sagens. For the execution of this program there remain along with the timber prepared in previous years in the forest, up to seven million cubic sagens which are to be considered the basis of timber supply, from which dry firewood is to be drawn for requirements in the course of subsequent working years or periods. Relatively the heaviest burden will lie on the governments of Viatka, Perm, Uphim, Simbirsk and Nizhegorod, which have been struck by the bad harvest; and this may of course necessitate the program of distribution to be lighter on these governments and the difference to be made up by other governments. Besides the program mentioned, the chief timber committee has planned a regular preparation of 15 million sleepers for the railway department. To execute this program the timber committee has formed a special sleeper section.

A Siberian Forest

doing all it can to provide for this supply.

The next most important consumer of timber is the mining industry, for which large quantities of props are required. The preparation of mining timber is worked out in a plan, and is distributed per region and government, to produce a total of 180,000 cubic sagens of oak and coniferous wood. The total quantity provided for in the 1921-1922 working year in respect to the inland market is a little over 110 million cubic feet and the total quantity arranged for in the same period for factories working for export is a little over 15 million cubic feet.

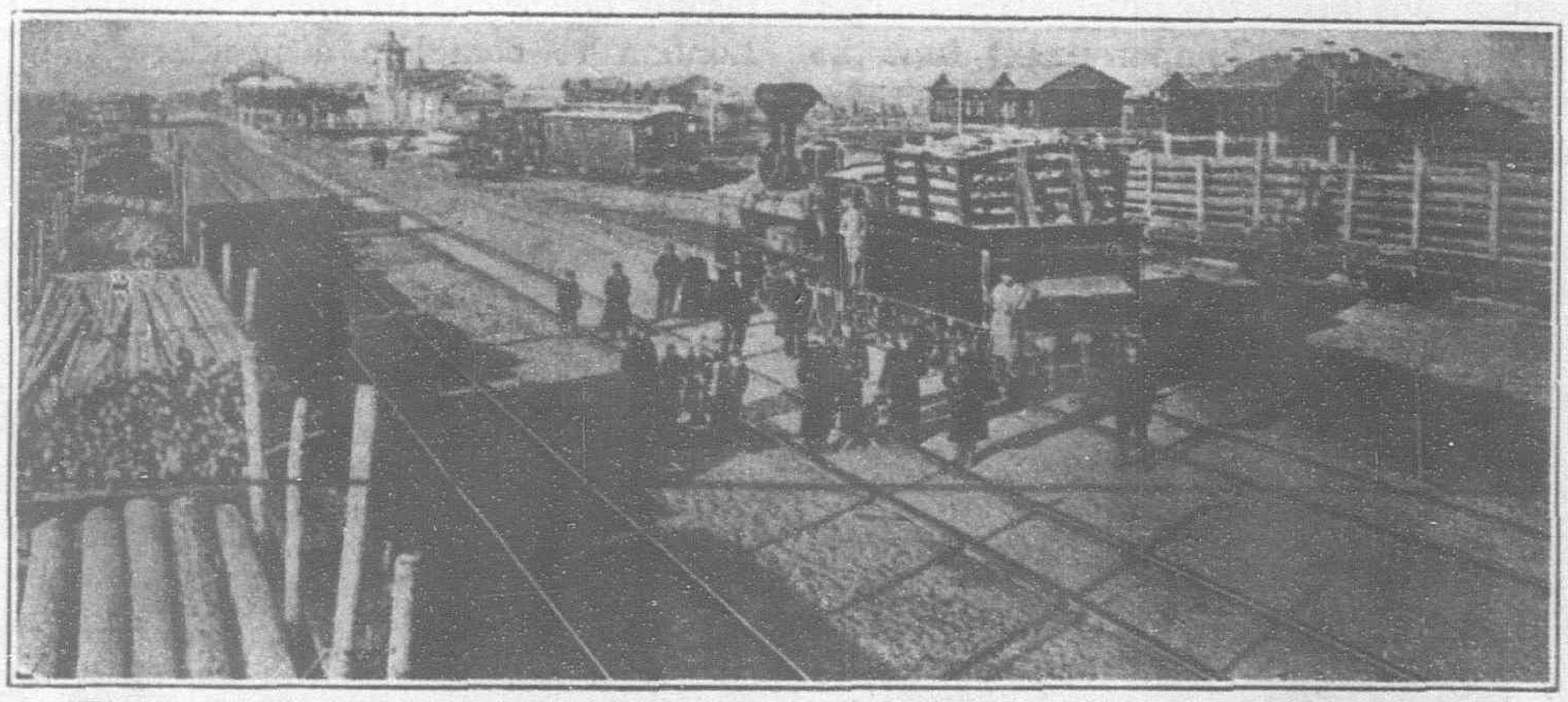
The chief timber committee is devoting particular attention at the moment to this question of export, which is recognized as an urgent department of business, not only because it helps to strengthen the industry itself and to insure its further development, but also because it furnishes the public with the means to purchase other kinds of fuel and thereby improve the fuel budget.



Lumber Rafts on the Amur River

Sleeper Districts Formed

Separate sleeper districts will be organized, where both the supply of the timber and its cutting at the factories will be specially superintended; and local organizations will be invited to assist. The next most important consumer in a government sense is the supplies (provision) committee. Here it is a question of packing materials, including the cooperage industry, which is mostly concentrated on the Caspian Sea; but later it is proposed to take measures to develop it on the shores of the Black Sea. Until now the cooperage industry on the Caspian Sea has been occupied mostly in providing tare for the fishing industry. For the moment this work is hindered by the limited supply of raw material for making casks, and the famine in the district, where it ought to be carried out, namely the Tartar Republic and along the River Vetluga. The chief timber committee is



Where the Wood Burning Locomotive Hauls Long Trains of Logs and Cut Timber for Building the Cites of Siberia

North Russian Timber Trust

A timber trust has been formed in North Russia under Soviet government auspices, the duties and rights of which are very extensive, including a control of both old and new timber concerns; that is, concerns that are served by the White Sea ports. Mr. Liberman, who is the managing director of this trust, in an interveiw with a Latvian journalist, said that the board of the trust is composed of experienced people, which assures it of competent guidance. This trust, which goes under the name of "Severoles," operates in a district that works almost entirely for foreign markets. And for food supplies and such like it will even depend for some time on foreign sources. The trust will operate with considerable freedom from government control; but is obliged to set apart 20 per cent. of its revenue every year for equipping and developing the northern district. The resources of this trust are listed as follows: The area handed over to it by the government makes about 30 million dessiatines of forest land, and the number of saw frames already in the area is 180. It has received the requisite funds to buy up the sawn wood in the area under its control, which it is under obligation to realize on the foreign market. In material means the trust is fully assured and it can begin work at once.

At first it will operate with its own means and start the 180 saw frames; but it will endeavor to make terms with foreign capital, for the 180 frames referred to can barely deal with a quarter of the timber resources at the disposal of the trust.

Mr. Lieberman suggested several ways by which foreign capital might share with the trust in the development of Russia's northern timber lands. He insisted that there is plenty of room in Russia for work and that foreign enterprise may take a hand at once; therefore the question of granting concessions for the erection of new concerns is an immediate one. He had every confidence in the success of the big concern at the head of which he stands.

Talking of the timber ready for export he said that of 130,000 standards available 50,000 standards are ready to be shipped. The program of operations for 1921-1922 has already been drawn up. He has been put in possession of ample funds for the importation of the necessary provisions until navigation closes, and the first steamers bearing such provisions from abroad are already on the way to Archangel.

The establishments handed over to the timber trust include two rope works with all their raw material, and one textile factory with 175,000 poods of prepared flax, besides a number of other concerns. This trust will also organize its own dairy supplies, fishing stations, soap factories and the production of other material for the chemical treatment of wood, the product of which will also be exported abroad.

Japan Oil Reserves

THE Japanese navy which recently contracted to purchase from the Asahi Petroleum Company 400,000 tons of crude oil for fuel purposes still needs 100,000 tons more to use this year and after receiving bids from the Asahi Petroluem Co., Suzuki & Company, the Asano Bussan Kaisha and the Mitsui Bussan Kaisha, have decided to purchase the lot from the last named company for Y.30 per ton. It is said that the Mitsui Bussan Kaisha intends to import most of this oil from California.

Coincident with the placing of this order, it is reported that the naval office will give contracts for the shipment of foreign oil to private companies in order to protect the private-owned tankers. Such tankers as possessed by private firms are the *Tachibana Maru* and the *Manju Maru*, each 3,800 tons, all property of the Teikoku Oil Company, and the *Kiyo Maru*, 13,000 tons, of the Toyo Kisen Kaisha. The *Tachibana Maru* and the *Manju Maru* are now engaging in the transportation of oil from the Persian Gulf to Japan for the company's exclusive use, but upon the prospective merger of the company with the Asahi Petroleum Company next June the transportation from Persia will come to a close. At the same time, these two tankers will take up the service of carrying foreign oil for the navy and will proceed to the Californian coast. The steamer freight will be fixed at the neighborhood of Y.12 per ton.

There is every reason to believe that the usual criticisms will now be directed against Japan for purchasing oil from abroad while her natural resources are estimated to meet her demands at the present rate of consumption for 300 years. Some time ago a section of the American press seemed to see in Japan's unusual importation of American and Canadian lumber, sufficient justification for the basis of another war scare while others condemned her for saving her own timber supplies by purchasing abroad. Whatever Japan does seems to have some sinister purpose for some people, and with the recent report on her petroleum resources read before the American Institute of Mining and Metallurgical Engineers, we may expect further condemnations of her policies. The full report has not yet reached us, but a statement issued before the meeting of the above institute summarized the conclusions regarding Japanese oil resources and forecasting the discolsures to be made.

The paper on Japanese oil resources was prepared by Mr. J. Morgan Clements, a well-known mining engineer and geologist of New York, who maintains that "considering her actual requirements, it appears that Japan is more fortunate than most nations in the possession of oil reserves for the future. Her needs in this respect are not a good reason for the island of Saghalien nor any territory on the mainland of Asia. In fact, Japan possesses much more oil than her propagandists have tried to make the world believe she has."

Mr. Clements recently investigated the Japanese oil fields. He is probably the best informed foreign geologist on the oil fields of that country.

If Japan has an oil supply for 300 years, and the United States for only twenty years at the present rate of consumption, it certainly is time for America to begin saving and to back the state department in insisting on the open in all parts of the globe for oil prospecting and exploitation. America has been very prodigal in exploiting her oil reserves for the benefit of the world and the time must be rapidly approaching when exports must be limited unless American capital and enterprise opens up new fields in other countries. If Japan has resources for another 300 years, it would be interesting to learn the opinion of experts on the oil resources of China.

Japanese Pearls Equal to Natural Gems

A FAR-REACHING decision was recently handed down by the French government when Japanese culture pearls were classified as equal to the natural gem, and as a consequence of this decision a suit for 100,000 francs damages has been filed in Paris by a dealer in the Japanese pearls against the national chamber of dealers in diamonds, pearls and precious stones.

In maintaining his stand in the face of the opinion of French scientists that Japanese pearls are not equal in value to the finest natural pearls, the president of the national chamber of dealers in diamonds, pearls and precious stones is confronted with the possibility of having to pay a member of that body 100,000 francs. At the same time the status of Japanese pearls has once and for all product of Japanese ingenuity now ranks with the precious stones of the world.

The long and bitter fight waged by French jewel merchants against the forcibly grown pearls of the Orient was brought to a climax last November when the chamber of dealers refused to permit one of its members to import forty Japanese gems from London to complete a necklace that had been ordered. This member, M. Pohl, had to make his request to this body, as it held the monopoly on the importation of pearls from all countries. The president of the association, in conformity with the opinion held by that body, replied that Japanese pearls were not in the category of gems authorized to pass the frontier.

M. Pohl appealed to the Japanese embassy, which in turn made representations to the finance minister. The minister, after consulting French scientists, immediately classed the Japanese product in the class of fine pearls. In addition to severely criticizing the syndicate, the government withdrew from that body the control over importation of pearls and placed it in the hands of the French customs.

M. Pohl, having won his case, filed suit for 100,000 francs damages because of alleged injury to his business.

Naval Bases, Radio Stations and Cable Communications on the Pacific

By Richard Ernest Lambert, Lecturer on Ports and Terminals, the School of Commerce, New York University, and Former Lieutenant U.S. Navy and Naval Supply and Disbursing Officer, Honolulu, Hawaii

WITH the control of the Pacific one of the fundamental questions being deliberated by the arms conference a survey of the naval bases and communications has its place. From the point of view herein presented, the terms " naval bases " and " naval stations " have not been used in their restrictive technical sense primarily the endeavor rather has been to picture in the broadest way possible all naval factors as far as is possible.

In order that the reader may have in a single picture that part of the strategic background against which the searchlight of the Far Eastern discussions is being thrown, which is comprised of such bases of major strategic importance as naval stations, radio stations and cable stations, a comprehensive list of such stations is given here for all the countries of principal interest. These lists are submitted without any comment, editorial or otherwise, since it is believed that they speak for themselves—and that most eloquently—, and besides it is believed that the reader will prefer in this instance to draw his own conclusions.

In one or two instances, because of their paramount strategic importance affecting Britain's position in the Far East, British stations not strictly speaking located in the Pacific arena, are included.

I. United States

A. NAVAL STATIONS

(1) MAIN LAND OF THE UNITED STATES

San Diego (Training Station, Aviation Base, and Marine Base)
San Pedro (Submarine and Torpedo Destroyer Base)
San Francisco (Training Station)
Mare Island (Navy Yard and Torpedo Storage)
Astoria, Ore. (Columbia River Submarine and Destroyer Base)
Keyport, Wash. (Torpedo Storage)
Sand Point, King Co., Wash. (Aviation Base)
Bremerton (Puget Sound Navy Yard)
Port Angeles, Wash. (Submarine, Destroyer, Aviation Base)

(2) PACIFIC POSSESSIONS

Alaska—None developed
Hawaiian Island—Pearl Harbor, Oahu
Philippine Islands—Manila, Ologanpo, Cavite
Guam—Marianas or Ladrone Islands
Pago Pago (Tutuila, Samoa).

While the Panama canal is in no sense a naval base or station, it should be included in any such survey as this present one, perhaps because it is in some respects a United States fortification, but more particularly because of its great importance in any Pacific Ocean study. Therefore we include Balboa, the Pacific terminus and Crystalbal (Colon) the Atlantic terminus of the Canal.

B. RADIO STATIONS

(1) U. S. NAVAL RADIO STATIONS

Alaska: St. Paul, St. George,—both on Pribilof Island; Dutch Harbor, Kodiak, Cordova, Sitka (old Russian capital) Seward, Juneau (American capital), Ketchikan.

(2) U. S. ARMY

Alaska: Nome, Fort St. Michael, Kotlik, Wrangell, Craig.

(3) PRIVATELY OWNED

Alaska: Chicago, Port Moller, Libbyville, Latouche, King Cove.

(4) ALASKA ENGINEERING COMMISSION ANCHORAGE

(5) OTHER U. S. RADIO STATIONS IN THE PACIFIC

(*a*) *Mainland:* Keyport, Wash.; Puget Sound (Bremerton, Wash.); Tatoosh Island, Wash.; North Head, Wash.; Seattle, Wash.; Portland, Ore.; Astoria, Ore.; Marshfield, Ore; Eureka, Cal.; San Francisco, Cal.; Point Arguella, Cal.; San Avalon, Cal.; San Diego, Cal.; and Farrallon Islands (off the coast of San Francisco); Mare Island Navy Yard.

(*b*) *Hawaiian Islands:* Pearl Harbor, Heeia Point; Wahiawa; Lihue Kauai; Kawaihae; Lahaina; Kaunakakai.

(*c*) *Philippine Islands:* Fort Mills (Corregidor Island).

Insular Owned: San Jose (Mindoro); Cuyo; Puerto Princess; Malabang; Davao; Zamboango; Jolo and Cavite.

(*d*) *Other Pacific Possessions:* Samoa (Tutuila); Balbao, C. Z.; Guam (Ladrone Islands).

(*e*) *Peking* (" Courtesy " station within American Legation).

II. Great Britain

A. NAVAL BASES

Canada—Dominion: None developed, but potential at Vancouver, Victoria, Prince Rupert (all British Columbia).

Imperial Stations at Hongkong, Weihaiwei, and Singapore. A naval station of first-class importance is located in Hongkong; one of the greatest navel stations iin Asia is to be developed at Singapore. At the fortified harbor of Aden, Arabia, a port of extraordinary strategic importance, a large coaling station is situated. The harbor of Columbo, Island of Ceylon, in the Indian Ocean, is a protective harbor.

Australasia—Commonwealth of Australia: Sydney is a first-class naval station; headquarters of British Fleet in Australasia. New Zealand: Auckland.

B. RADIO STATIONS

(1) *Canada:* Digby Island (Prince Rupert); Gonzales Hill (Victoria); Point Grey (Vancouver); Cape Lozo; Pachena Point; Estevan Point; Triangle Island; Ikeda Head; Dead Tree Point; and eight private commercial stations of minor size—all in British Columbia.

(2) *Australia:* Port Moresby; Thursday Island; Cooktown; Townsville; Rockhampton; Brisbane; Sydney; Finders Island; Melbourne; Hobart; King Island; Mount Gambier; Adelaide; Esperance; Perth; Geraldton; Broome; Roeburne; Wyndham; Darwin; Samarai; Woodlark Island; Cocos Island. Included with the Australia Radio stations should be listed those of foreign German territory now administered by Australia: Rabual; Madang; Nauru; Kieta; Bita Paka; Morobe; Eitape; Manus; Kaewieng.

(3) *New Zealand:* Auckland; Suva; Labasa; Taveuni; Savusavu; Awanui (Auckland); Awarua; Wellington; Chatham Island; Apia (Samoa); Raratonga (Cook Island).

C. CABLE COMMUNICATIONS

Canada: Bamfield, British Columbia.

Australia: Sydney, Melbourne, Adelaide, Brisbane, Darwin, Fremantle, Cocos Island, Southport, Botany Bay, Burnett Heads.

New Zealand: Auckland, Wakapuaka, Wanganui, Doubtless Bay.

Tasmania: is connected with both Australia and New Zealand by cable.

Fijis : Norfolk Island, Fanning Island stations.

Great Britain also has Cable Stations at Hongkong, Penang, Malacca, Singapore, Sandakan.

III. Japan

A. PORTS AND NAVAL BASES

There are more than a thousand Japanese harbors that are visited by merchant men. Of these there are about sixty harbors open to the call of foreign steamers, which include eleven for Formosa and ten for Korea. Of these sixty, thirteen stand out most prominently from the standpoint of harbor improvements, reclamation or dredging. Of the thousand harbors, three hundred and fifty are used by coast steamers and thirty-six are known as open ports. Two are known as fortified ports and four as naval bases. It is these last six in which we are particularly interested.

The two fortified ports are Shimonoseki and Tsushima. The complete Japanese coastal defense program includes also fortifications to be constructed in the Kii and Bungo Channels, at Amami, Okunawa and Akum—all three in the Lu Chiu Islands archipelago ; mine fields in the channel between Sakhalin and Yezo and between Yezo and Nippon ; fortification area on the Bonin Islands, and of course Port Arthur and Kiaochow.

The naval bases are those at which the four admiralties have their headquarters : the dock-yards of Yokosuka, Kure, Sasebo and Marizuru. These all possess dry-docks for accommodating was ships. In addition to these Port Arthur possesses a dry-dock but lacks necessary equipment for building war-ships. Two other dock-yards which have built war-ships are the Mitsubishi Ship Yards at Kobe, and also the Osaka Iron Works. In addition to these there are about eight other leading commercial dock-yards.

Tsuruga is a connecting port with Siberia, reconstructed in 1913 at an outlay of Y.800,000.

B. RADIO STATIONS

Radio Shore Stations	Vibration Metre			Electric Power K. W.		Distance of transmission (naut. mile) Day time	Night time
Funabashi (of the Imperial Navy, for Communication with Hawaii, the largest in the country) ..							
Ochiishi (Hokkaido)	300	600	1,800				
Choshi (Shimosa)	,,	,,	,,	7	(Quenched spark)	600	1,800
Shimizaki (Kii)	,,	,,	,,	30	,,	1,500	3,000
Tsunoshima (Nagato)	,,	,,	,,	3	,,	400	1,100
Osezaki (Hizen)	,,	,,	,,	4	(Ordinary spark)	400	1,100
Shimotsui (Inland Sea)	,,	,,	,,	30	(Quenched spark)	1,500	3,000
Rasa Island (Loochoo)	,,	,,	,,	4	,,	300	1,000
Cape Fuki (Formosa)	,,	300	600	3	,,	450	1,300
Dairen (Kwantung)	,,	,,	,,	4	(Ordinary spark)	450	1,200
				7	,,	500	1,300

Japan is a member of the international wireless union, and regulates the exchange of wireless between these ten coast stations and foreign steamers or between Japanese steamers and the coast stations in foreign countries under rules drawn up based on the principles laid down at the international radio-telegraph convention of Berlin, which regulations were put into effect July, 1919.

C. CABLE COMMUNICATIONS

By agreement made in 1870, Japan conceded to the Great Northern Telegraph Company of Denmark the exclusive right of landing on Japanese territory cables for international service.

Cables were laid between Nagasaki and Shanghai, Nagasaki and Vladivostok, and Nagasaki and Fusan. The cable between Nagasaki and Fusan (leading Korean port) via Tsushima (situated in the Straits between Japan and Korea) was laid in 1882 under charter foe thirty years. Japan purchased the first section of this Nagasaki-Fusan cable as far as Tsushima in 1891. After the annexation of Korea, in October, 1910, to be more exact, the second section of this cable from Tsushima to Fusan was acquired. About this time the work of laying an additional cable between Japan proper and Formosa was completed.

During the Russo-Japanese war Japan laid a cable between Sasebo and Dairen (South Manchuria) and next from Dairen to Chefoo (northern province of Shantung, China). Other cables between Nagasaki and Shanghai and connecting Japan with Siberia are also projected.

Summary of Japan's International Cable Stations

Nagasaki	to	Shanghai
,,	,,	Vladivostok
,,	,,	Fusan, via Tsushima
Sasebo	,,	Dairen, to Chefu.

IV. China

A. PORTS AND NAVAL BASES

There are forty-eight main treaty ports known as Customs stations in all the provinces in China. Naval docks are located in the Chihli, Shantung and Fukien provinces. Both Nimrod Sound and Santuao are candidates for the chief Chinese naval base.

Naval school, recently reorganized on the British system, are located at Chefu, Nanking, Foochow and Canton.

B. RADIO STATIONS

(1) There are wireless installations at Dairen (Dalny), Hongkong, Peking (Chinese government, American legation, and Italian legation), Port Arthur, Shanghai (Chinese government), Tsingtao, Weihaiwei, Woosung.

(2) *Wireless Telephone.*—On August 24, 1918, a contract was concluded between the Marconi Company and the Chinese government for the supply of two hundred wireless telephone instalments each having a range of forty miles.

C. CABLE COMMUNICATIONS

Telegraph connections have been made with the four cable companies operating in China ; with Russia and Japan in respect to the Manchurian telegraph system ; with Japan regarding the cables between Dairen and Chefoo, and between Shanghai and Nagasaki ; with Germany (now with Japan) in respect to the German cables connecting Shanghai, Tsingtau, Chefoo ; with India and France in respect to the communications and the Burmese anñ Indo-Chinese frontiers.

The four cable companies operating in China are—

(1) The Great Northern Telegraph Company Ltd. of Denmark

(2) The Eastern Extension, Australasia and China Telegraph Company, Ltd. British)

(3) The Commercial Pacific Cable Company (American)

(4) The Deutsch-Niederlandische Telegraphen Gesellschaft (German-Dutch).

Main cable offices are at Suikai, Tunghing, Hokow, Cheunnankwan, Manyün, Maimatchen, Tarcheng, Helampo, Hunchun, Shanghai, Chefoo, Tsingtao, Foochow, Amoy and Hongkong.

Vacuum Drying in Modern Industries

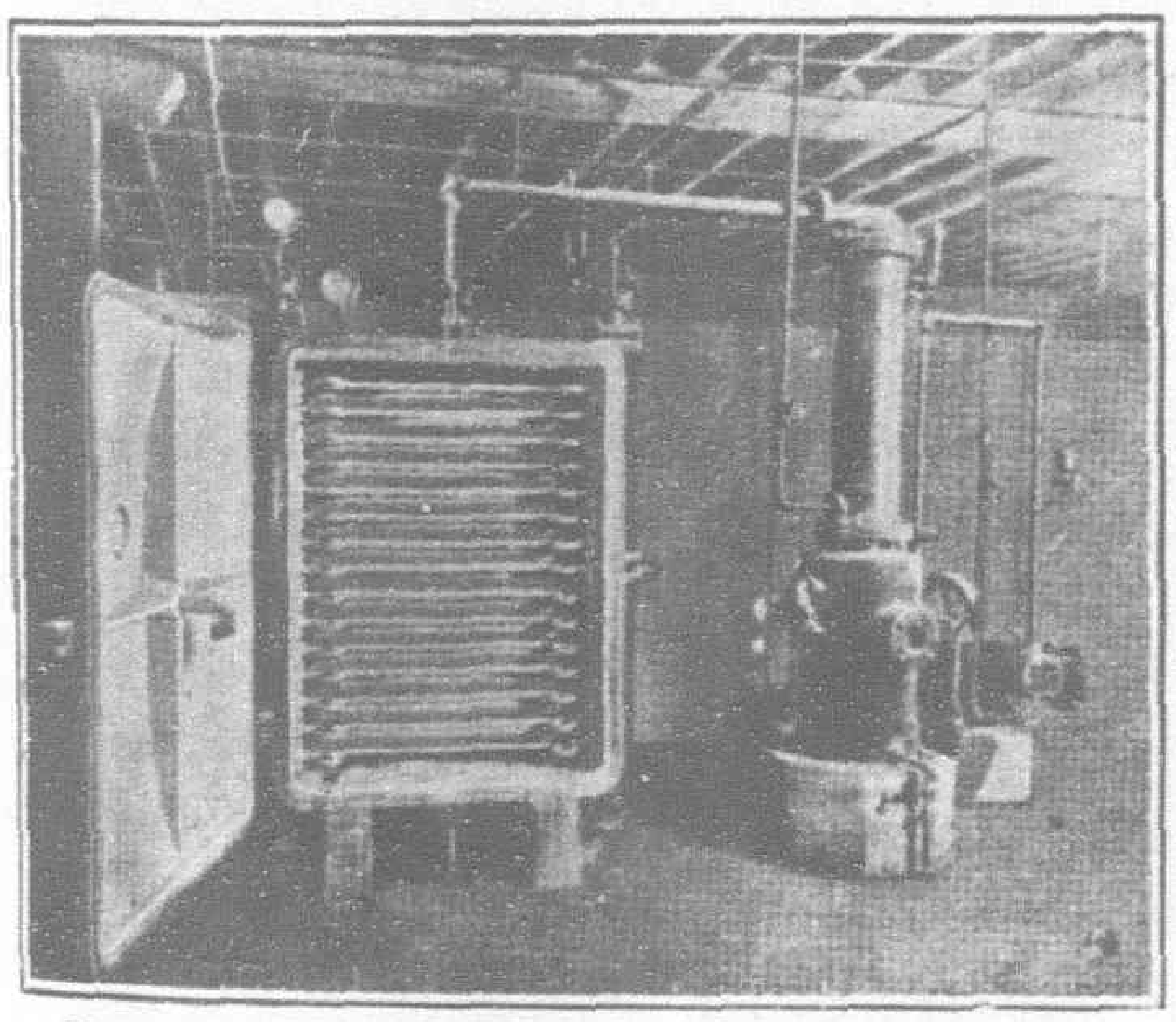
By James S. C. Chen, Research Chemist and J. P. Devine Co., Research Laboratory

(Presented at the Seventh National Exposition of Chemical Industries, Sept. 14, 1921, New York City)

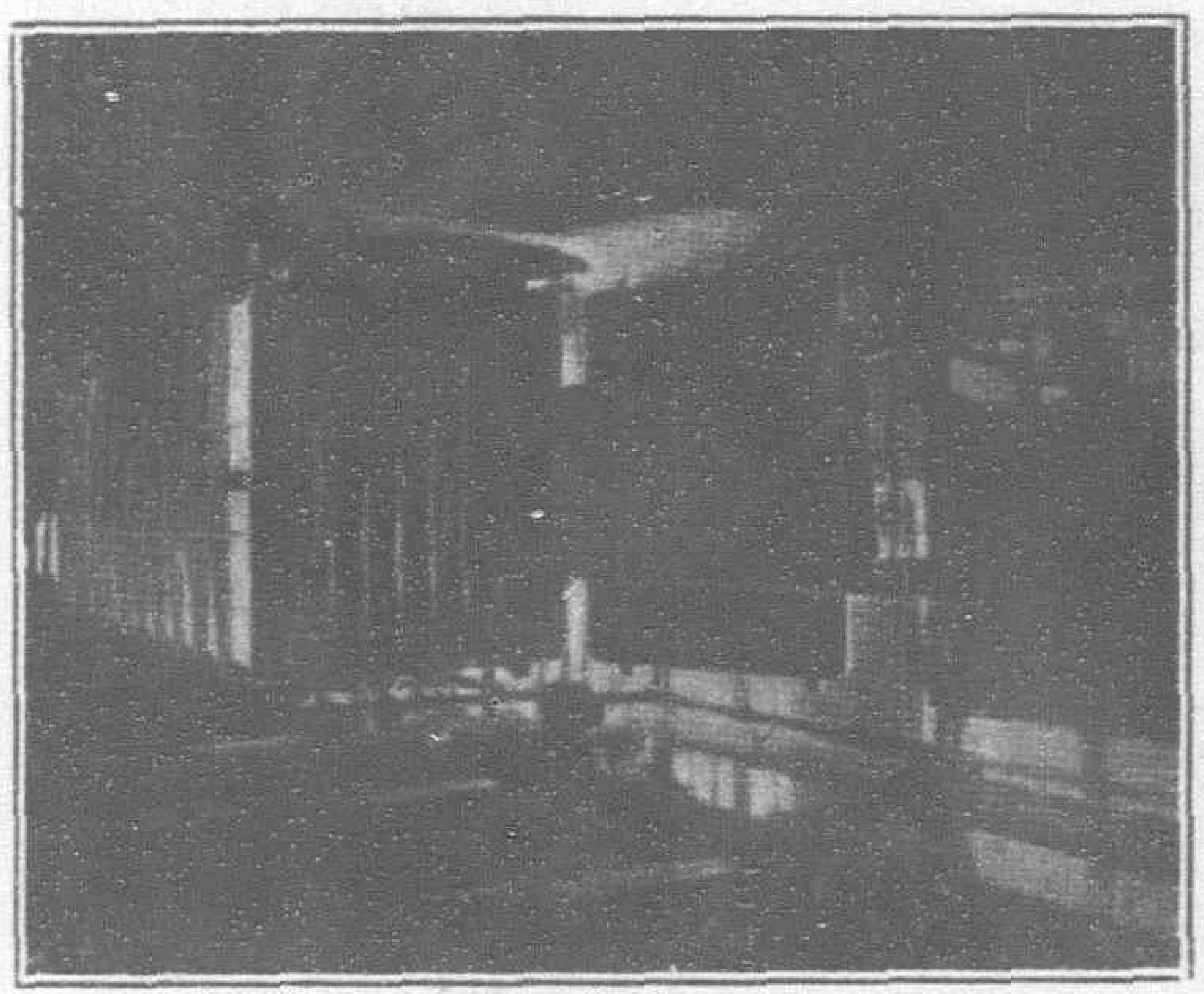
THE recent war has exerted a profound influence on the industries of America; among these industries, none perhaps has received a greater impetus than that which deals with the manufacture and refining of organic materials. As the quality of organic products depends in a great measure on the apparatus employed, it is essential that the manufacturer possesses a thorough knowledge of the methods of production and refining, in order that he can supply a superior product to the world market.

James S. C. Chen, B.S.

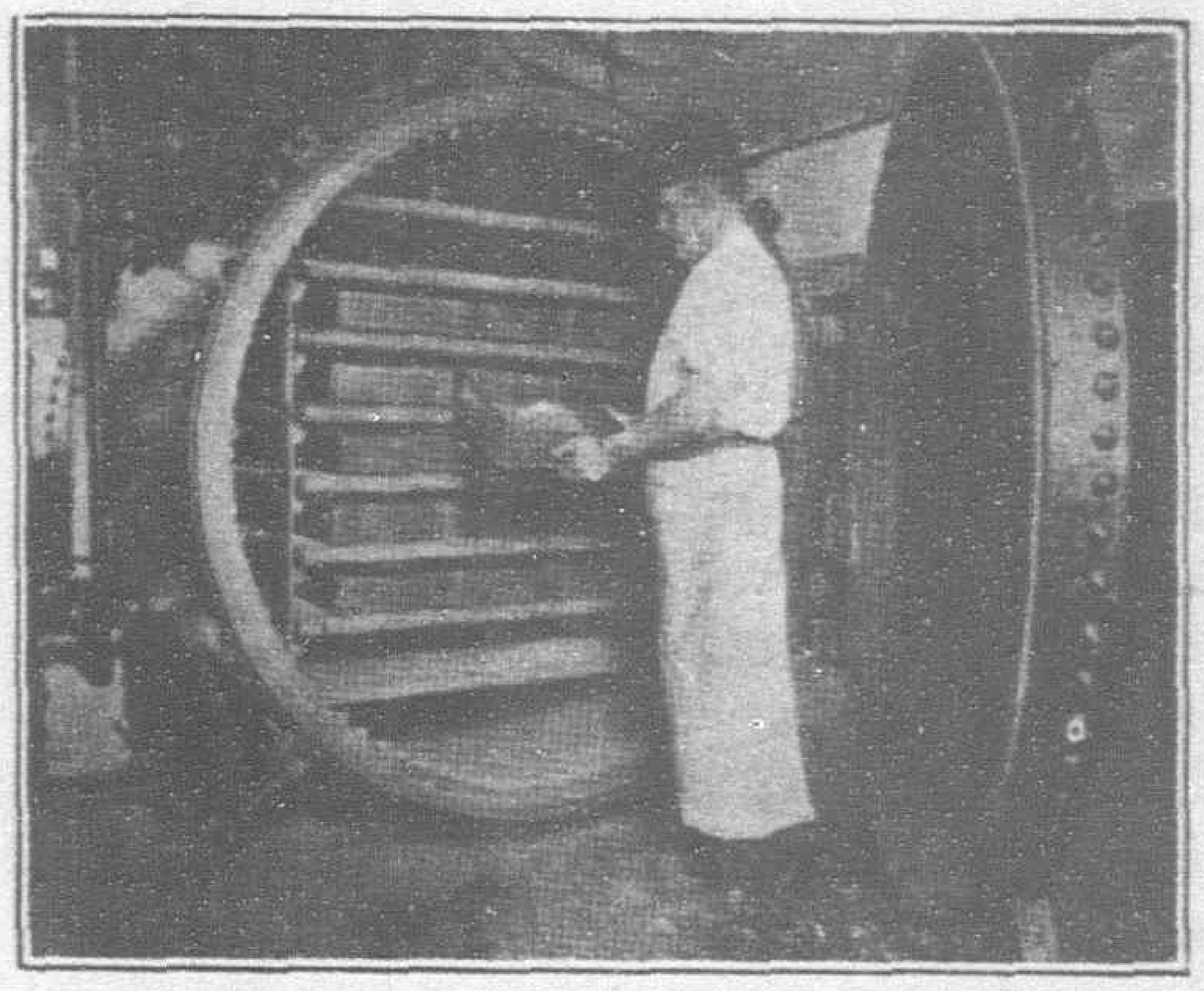
Vacuum drying, which was used only in limited fields in the past, has in recent years attained a position of such importance in the chemical and allied industries that it is worth while to make a thorough and comprehensive study of the subject. It is the purpose of this article, first, to give an outline of the fundamental principles and advantages of vacuum drying, then to discuss a few types of vacuum drying apparatus, and finally to set forth the result of an investigation as to what extent vacuum drying has been applied to the chemical and allied industries up to the present time, and how it may be advantageously used in other industries which hitherto have never applied vacuum drying in their processes.



Vacuum Chamber Dryer and Auxiliaries, Figure 1



Vacuum Vertical Chamber Dryer, Figure 2



Vacuum Safety Chamber Dryer, Figure 3

I.

Drying, as it is ordinarily understood, means simply a process of removing moisture from a solid material, but applied to vacuum drying apparatus, it signifies a process of removing moisture or other volatile liquids from a material which may be in the liquid or solid state.

The process of removing moisture from a material depends on supplying enough kinetic energy to the molecules of the moisture by heating. The heat is used for three distinct purposes:

(1) That a definite amount of heat is required to transform the moisture from the liquid to the gaseous phase.

(2) That additional heat is required for the molecules to overcome inter-molecular attraction between the moisture and the material.

(3) And, finally, still additional heat is necessary for the molecules to overcome atmospheric pressure.

Frequently the heat that is required for the molecules of the moisture to overcome atmospheric pressure is sufficient to cause decomposition of the material. This condition necessitates the the use of vacuum drying. Furthermore, it is a well-known fact that the last trace of moisture is the most difficult to remove from any material; take starch for example:

100 Grams of Dry Starch

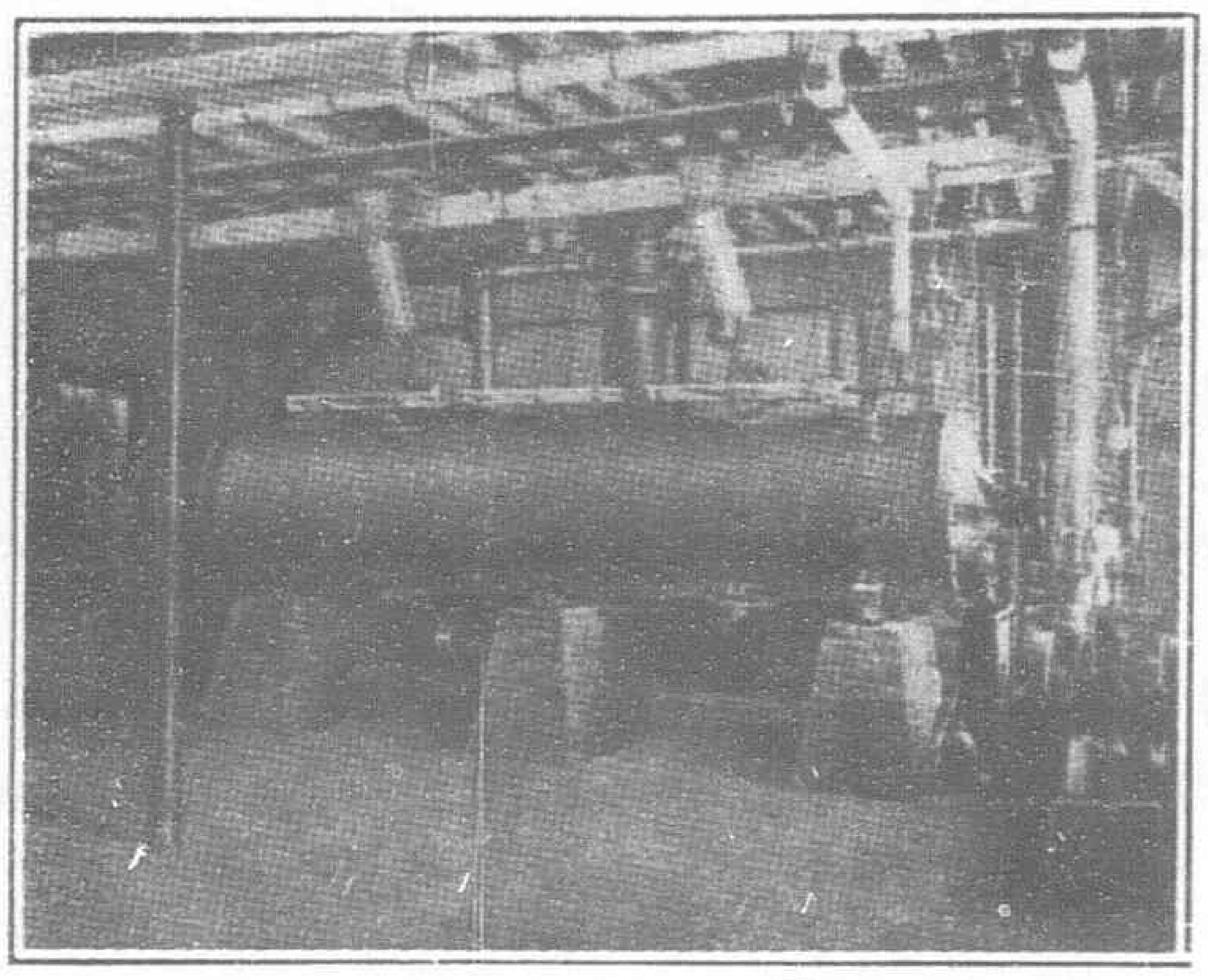
Per cent. of Water	Heat of Imbibition in Calories
.23	28.11
2.39	22.60
6.27	15.17
11.65	8.43
15.68	5.21
19.52	2.91

As a large quantity of heat is produced by a small initial quantity of water, according to the principle of the heat of imbibition, it would require the same quantity of heat to remove the last trace of moisture from the starch. This accounts for the difficulty met in the removal of moisture from organic materials. Vacuum drying is based on the elimination or reducing of the pressure on the surface of the material, and thereby accelerates the rate of evaporation.

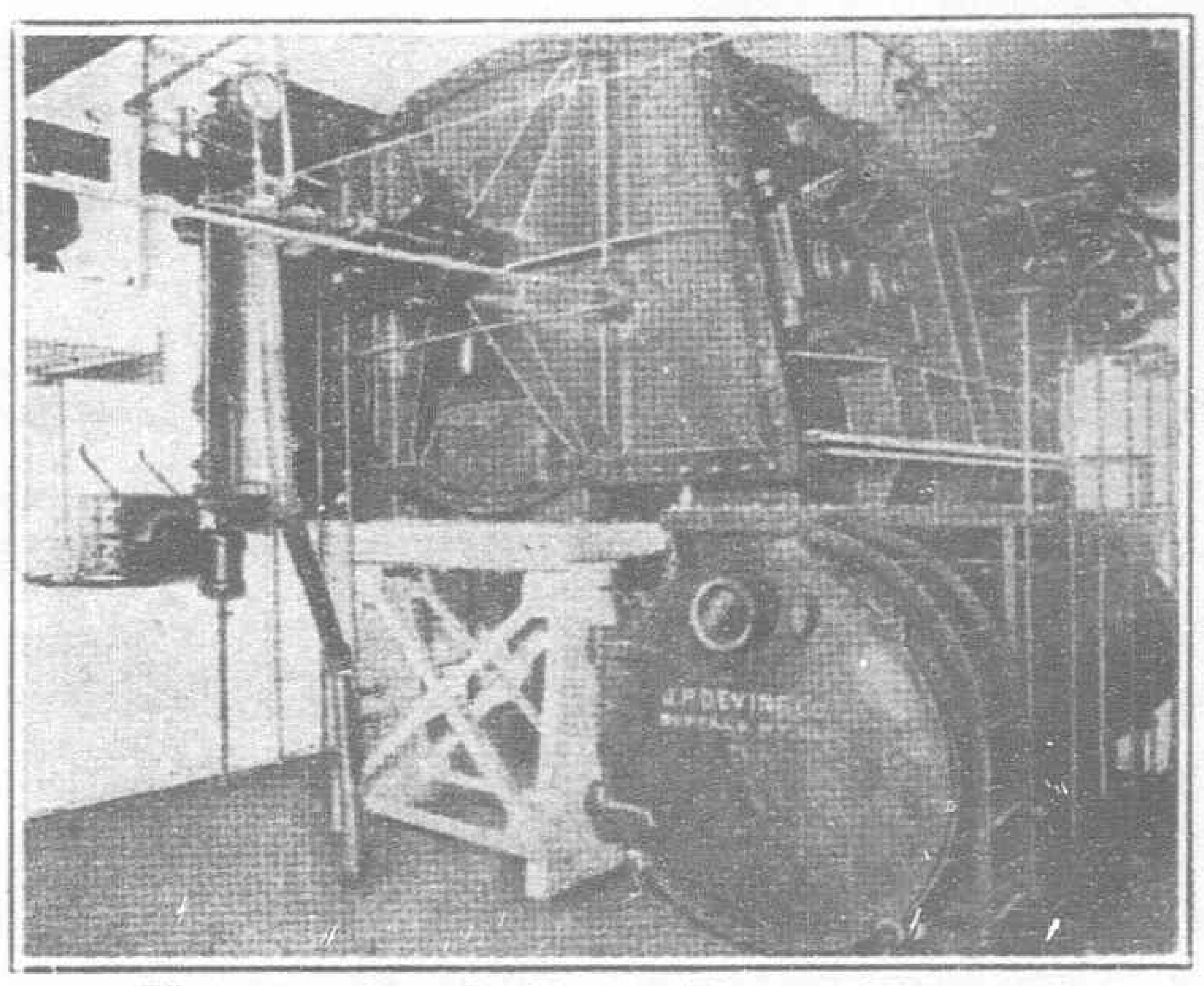
But, if vaccum drying were used only for the aforesaid purposes, its part in the industries would be a limited one indeed. At present vacuum drying is extensively used in the chemical and allied industries not only because its use is in many instances imperative, but because the process is efficient, economical and insures superior and uniform quality of the finished product.

In the drying of organic substances, oxidation frequently takes place on the surface, which either changes the character of the material entirely, or gives an inferior product by altering the physical appearance.

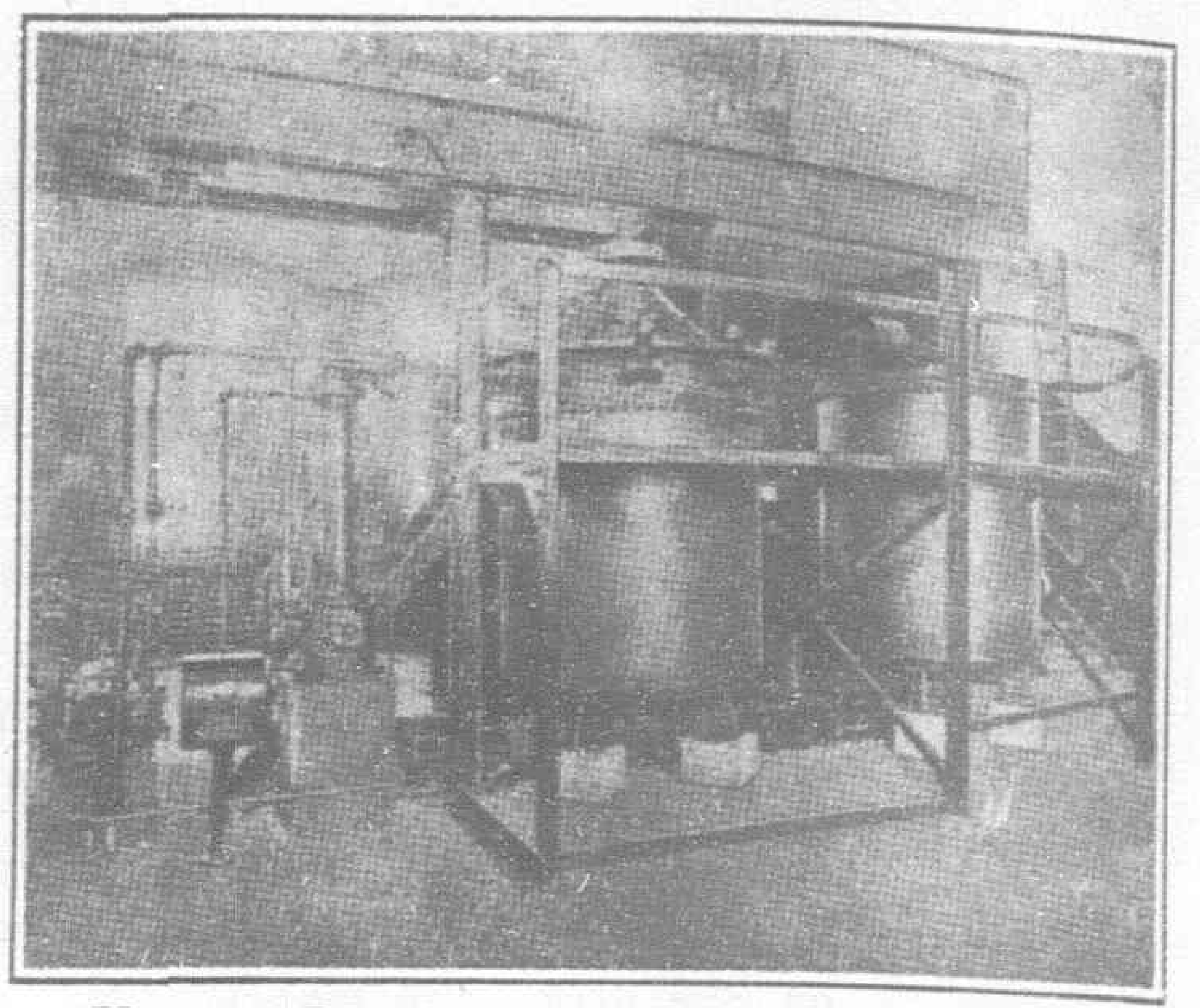
The writer recently demonstrated that the so-called "white sugar" which is marketed in the Far East, is greatly improved by being dried in vacuum, as the major portion of the sugar sold in the Far East is straw colored, which is evidently due to surface



Vaccum Rotary Dryer, Figure 4



Vaccum Single Drum Dryer, Figure 5



Vaccum Impregnating Apparatus, Figure 6

oxidation, and which can be avoided in a proper vacuum drying apparatus.

When materials are not liable to oxidation, their character may be altered, either by overheating, or by long contact with a constant heating surface, as in the case of many drugs and albuminous substances. In the vacuum drying process not only can the heat be controlled to a fraction of a degree, but the contact of the material with the heating surface can be avoided, and when it is necessary for the material to come in contact with the heating surface it can be controlled to a fraction of a minute, thereby preventing the material from deteriorating.

Fire risk attends the drying process in plants of organix industries; this is especially true in the case of smokeless powder and other high explosives. Constant danger demands constant supervision along with enormous cost of labor and frequent damage both to life and property. In the vacuum drying process this danger is minimized, not only because there is no direct heating medium, but the drying can be accomplished at the lowest temperature in the shortest time.

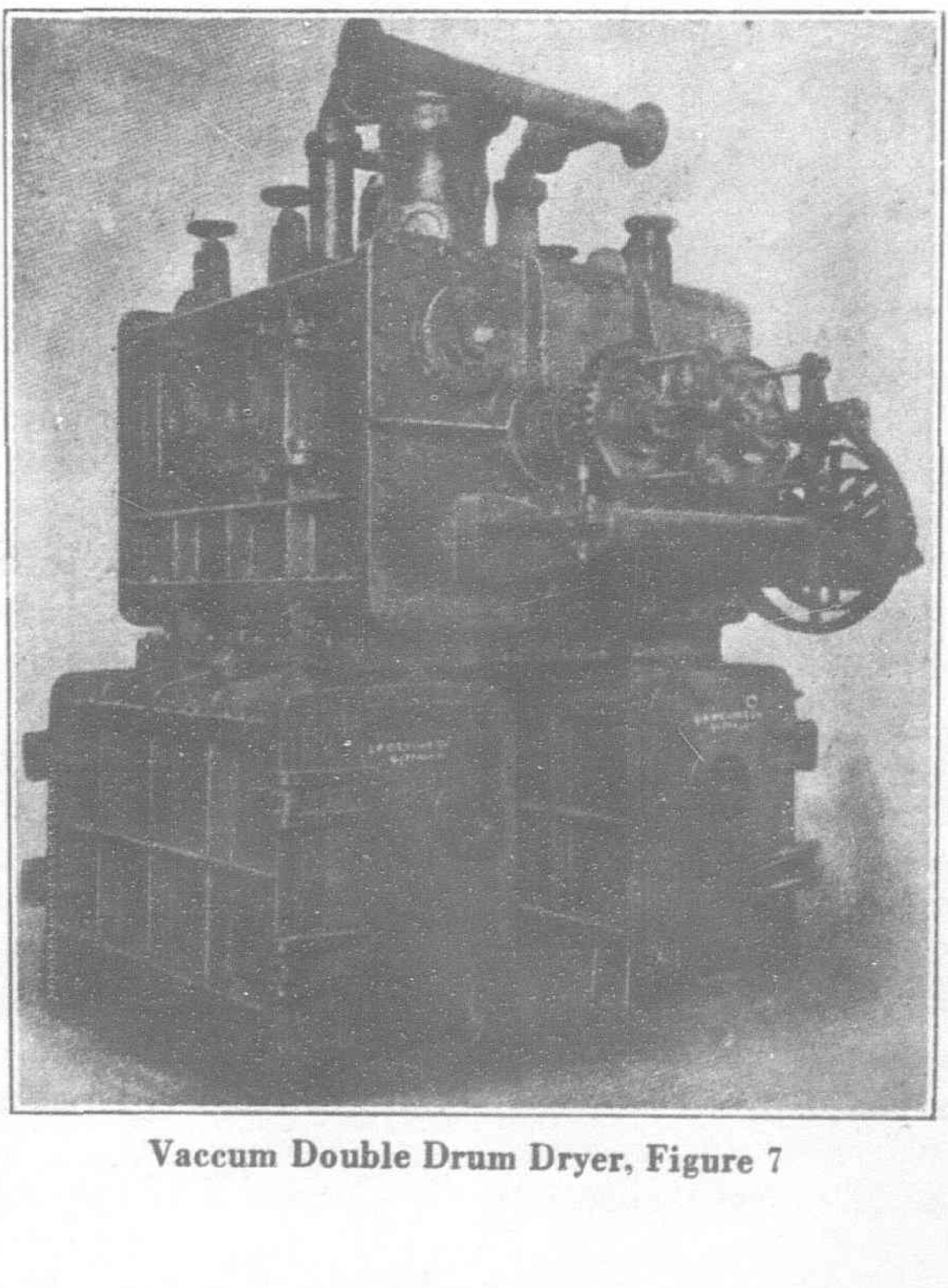
The fact that vacuum drying is independent of climatic conditions presents another distinct advantage. Any experiment or process once determined in vacuum can be accurately repeated. Would it not be a great advance in chemical science and industries, if the boiling point of all organic liquids were determined in a definitely reduced pressure?

Under certain circumstances vacuum drying is by far the most economical of all drying processes, in that it reduces the drying period and consequently the cost of labor to a minimum. The transmission of heat is exceedingly efficient, due in part to the high vapor pressure of the moisture and in part to the great temperature difference between the material and the heating medium, which in turn gives a high co-efficient of heat transfer. Moreover, exhaust steam or hot water may be utilized to advantage as a heating medium, because drying can be conducted at low temperatures.

Vacuum drying equipment occupies but small floor space, and requires comparatively low cost for its operation. Therefore, plants where vacuum drying has never been used usually can install a vacuum drying unit without fundamental modification of their arrangement.

In the drug and dye industries, valuable solvents are frequently used; these solvents can be completely recovered in the vacuum drying apparatus, which in this instance serves a double purpose.

In other industries, such as rubber, the quantity of solvents used is so great that in order to insure safety and economy the solvents should be completely recovered.



Vaccum Double Drum Dryer, Figure 7

Vacuum drying reduces the cost of transportation; in the past many food products, such as fruits, vegetables and dairy products, could not be advantageously dried without causing damage to their essential character and freshness. Hence, complicated and costly equipment was required for their transportation, which is made unnecessary by the vacuum drying process. When a certain percentage of moisture is desired in the material, its uniform distribution can be accomplished in the simplest manner in the vacuum apparatus.

The world demands a product of superior quality. No industry can long prosper or even survive if it ignores this fundamental point.

Not very long ago the writer personally worked on two entirely isolated drying problems, i.e., whole milk and chrome yellow. The milk that was dried to powdered form by the hot air method was only partly soluble in water at 70° C., while the same milk that was dried in vacuum was entirely soluble at the same temperature, and free from any randicity. But, milk dried by air under atmospheric conditions is noticeably rancid, evidently caused by the oxidation or overheating of the butter fats contained in the milk.

If it is possible to put color in words, this may be said with regard to chrome yellow, that the color of this dye is brighter when it is dried in vacuum than when it is dried in any other way. Further, it is possible by means of drying chrome yellow in vacuum to continually produce the same shade of finished product.

It is the general impression that the initial cost of vacuum drying equipment is too great to recommend it for general use. But, the economy of fuel, time, labor, coupled with the sturdy construction of vacuum drying apparatus and superior product make the use of vacuum drying not only desirable, but necessary, for it is certain that the future world market will be dominated not by the largest quantity but by the best quality of product. While the vacuum process may not be applicable to all drying problems, it certainly merits in each case careful investigation.

II.

Although it has been known for hundreds of years that under constant temperature the rate of evaporation increases as the atmospheric pressure decreases, vacuum drying did not find commercial use until Passburg invented vacuum drying apparatus. The Passburg patents were acquired and introduced into the United States by Mr. Joseph P. Devine of Buffalo, twenty years ago, and it is interesting to notice that by engineering genius and constant improvement the acquirer excels the inventor in more than one respect in the construction and application of vacuum drying apparatus.

There are as many types of vacuum dryers as there are drying problems; for the present, four of the most general types of vacuum drying apparatus will be discussed, i.e., the chamber dryer, the rotary dryer, the drum dryer and the vacuum impregnator.

Chamber dryers are of two general types, i.e., the rectangular and the cylindrical. The outer casing of the former is made of cast iron, while that of the latter is made of sheet steel. As the nature of the materials may require, the heating shelves are arranged either horizontally or vertically.

Figure 1 shows a vacuum chamber dryer; it consists of a heavily ribbed cast iron box in one or more sections; the doors are also made of cast iron, and attached to the body by double swing hinges. The dryer is made air tight by fitting a rubber ring into the groove on the inside flange, and observation glasses are fitted on the door for inspection and control during the time of drying. heating shelves are made of two rolled steel plates, welded at the edges and separated by spaces flush riveted at regular intervals. The heating shelves can withstand a test pressure of 100 pounds; they are very carefully made—the plates used for the making of heating shelves are hydraulically straightened, all holes are drilled and countersunk, and manufactured on specially constructed apparatus to insure perfect evenness and rigidity. Each heating shelf has its own independent steam feed and exhaust connections, giving complete drainage and allowing uniform heating. The arrangement of the distance between the heating shelves is a problem in itself, and is determined by the nature of the material to be dried. The principal points to be considered are the tendency of the material to effervesce during the drying process, the sensitiveness of the material to heat, and the height of the bubbles coming from the material caused by local conditions, that is, the temperature of the heating medium and the vacuum.

The capacity of the vacuum chamber dryer is based on the number of square feet of heating surface, which varies from a few square feet to several thousand square feet. The quantity of the vapor given off in a specified time must be taken into consideration in determining the capacity of the vacuum pump and that of the condenser. In order to secure the greatest efficiency of drying the capacity of both the vacuum pump and the condenser should be based on the peak of the load, for it must be remembered from the consideration of the heat of imbibition that other conditions being the same, the rate of evaporation will be the highest at the beginning of the drying, which steadily decreases until the last trace of the moisture is expelled. Should the capacity of the pump or condenser fall below the peak, not only would it be impossible to maintain the vacuum, but chemical reaction might take place between the vapor and the material on account of the rising temperature of the latter.

It is therefore of extreme importance that the capacity of the auxiliaries be calculated to fit the capacity of the vacuum chamber dryer, and what is true of the vaccum chamber dryer may be said for all drying apparatus.

The vacuum chamber dryer is used for drying all materials which can be handled on trays, and which do not need stirring during the process. The trays are made of steel, enamel or other materials, as the nature of the material may demand. The bottom of the tray must be as smooth as possible, so that uniform transmission of heat may be secured. In operation, the heating shelves are first of all heated with hot water or steam, then the vacuum chamber dryer is charged, and finally the vacuum pump is started. The loss of time for loading and unloading a vacuum chamber dryer was heretofore considered an objection, but this is no longer a serious matter on account of the improvement in auxiliaries.

The vacuum chamber dryer with vertical heating shelves, as per figure No. 2, is especially adapted to the drying of fabrics, lumber and felt, and all materials that must be placed in a vertical position during drying.

Figure 3 shows a safety vacuum dryer for the drying of high explosives; this dryer is equipped with safety valves with ground joints; the door and rear of the dryer are held to the body of the apparatus by a number of spring devices so that in case of internal explosion the pressure must build up to equal the pressure of the atmosphere, which releases the safety openings and doors, so that the damage is reduced to a minimum. Thus vacuum drying in the case of high explosives is not only the most economical process but the safest.

The rotary vacuum dryer is especially adapted to materials that can be stirred or agitated during drying. This type of apparatus consists of a steam jacketed outer cylinder with an interior rotating heating tube to which is attached adjustable stirring blades of very rigid construction. The materials to be dried are kept in constant motion, bringing new particles of the material in contact with the heating surface, so that the drying time is greatly reduced, and a very much larger quantity can be handled per charge.

When drying a material which has a tendency to coat the heating surface, the apparatus is installed with adjustable scrapers to prevent the coating of the heating surface.

The rotary vacuum dryer can be made continuous in operation, and is by far the most economical type of apparatus for handling granular or powdered materials.

For substances that can readily form a film the vacuum drum dryers are specially useful. There are two general types of vacuum drum dryers, namely, the double and the single.

The single drum dryer consists of an outer cast iron casing, inside of which rotates a hollow drum made of cast iron, bronze, gun metal or other materials. The drum is well balanced, polished and heated internally with hot water or steam, and where high temperatures are necessary, hot oil and even internal combustion may be employed.

The material to be dried is placed on the single drum in various ways; and the simplest method is to dip the drum into the material which is automatically regulated and kept at a constant level. The ends of the drum are protected by adjustable shield rings, thereby preventing the material from solidifying on them. When working with a material that is delicate and sensitive to heat, the film is placed on the drum by a small feeding-roller. The material is fed from a cooled liquor trough to the feed roller and thence to the large drum. In this way the material does not come in contact with any heating surface before it reaches the drum.

The vacuum double drum dryer is constructed on similar lines to the single drum dryer, and is of more recent development. It consists of two drums rotating in opposite directions, a knife device for the removal of the dried material, and an agitator to prevent the material from solidifying.

The vacuum double drum dryer has great advantages over the single drum dryer, as a larger quantity of material can be handled in a smaller apparatus; semi-liquid as well as liquid materials can be dried in a double drum dryer, and the difficulty of effervescing experienced with any type of single drum dryer, can be overcome in a double drum dryer.

Like the rotary vacuum dryer, both types of vacuum drum dryers are made continuous in operation.

The study of vacuum impregnation is at once fascinating and instructive. The apparatus consists of a liquor tank and a vacuum drying and impregnating chamber, which is steam jacketed. The materials to be impregnated are put in the latter while the former serves as a storage for the compound. The two are connected by steam jacketed pipes so as to prevent the compound from solidifying.

The materials to be impregnated are subjected to drying in the vacuum chamber as in the case of chamber drying, where the air and moisture in the material are rapidly removed. The liquified compound is now drawn into the chamber. On account of the absence of air and moisture the compound immediately penetrates the innermost recesses of the material. To render the penetration of the compound more rapid and thorough, the action of the vacuum pump is reversed, changing it into a compressor, and the combined action of vacuum and pressure results in a uniformly impregnated product in a short time.

Mindful of the fact that it is not possible to do justice to all types of vacuum drying apparatus, it is opportune to investigate just to what extent the foregoing mentioned apparatus have been applied to modern industries.

III

Extensive investigation with regard to the application of vacuum drying to modern industries has disclosed the fact that during the last twenty years, thousands of substances, representing hundreds of industries, hav been successfully dried by the four types of apparatus just discussed. To enumerate them would serve no useful purpose, for in many cases the requirements of the different industries concerning the quality of their products are identical. It is the object, therefore, of this article to give just a few of the leading industries along with some typical substances, in which the use of vacuum drying has proven to be a distinct advance.

I. FOOD INDUSTRIES.—The fundamental requirements with regard to drying in food industries is not only the reduction of the bulk of the products whereby the same can be easily transported from place to place, but the conservation of the freshness and the essential qualities of the food articles, such as odor and taste. These conditions can only be successfully met by the vacuum drying apparatus, and the drying of such articles as meats, meat extracts, fish, eggs, milk, vegetables, vegetable extracts, fruits, nuts, cocoa, tea, coffee, chocolates, biscuits, corn, cereals, starches and yeast will speak for themselves.

FRUITS AND VEGETABLES.—Weight of dried fruits and vegetables produced from 100-lbs. of green product: Apples, 12.5-lbs.; cherries, 6.6-lbs.; pineapples, 10-lbs.; plums, 33-lbs.; cranberries, 10-lbs.; currents, 14.3-lbs.; huckleberries, 14.3-lbs.; lemons, 14.3-lbs.; oranges, 16-lbs.; beans, 7.1-lbs.; beets, 7.-lbs.; cabbage, 5.5-lbs.; carrots, 7.6-lbs.; cauliflower, 4-lbs.; celery, 5-lbs.; corn (green), 8.3-lbs.; egg plant, 6.3-lbs; leek, 10-lbs.; lima beans, 12.5-lbs.; okra, 12.5-lbs; raisins, 25-lbs; raspberries, 14.3-lbs.; rhubarb, 5-lbs.; peaches, 10-lbs.; strawberries, 5.5-lbs.; parsley, 9-lbs.; parsnip, 20-lbs.; peas, 12-lbs.; potatoes (white), 17-lbs.; potatoes (sweet), 12.5-lbs.; pumpkins, 8.3-lbs.; rhubarb, 5-lbs.; spinach, 7.1-lbs.; tomatoes, 5-lbs; turnips, 6-lbs.

II. CHEMICAL INDUSTRIES.—The world demands purity of chemicals. This requirement must be met during the process of refining, when the last trace of moisture is to be removed and where contamination, due to the presence of air, metallic contact and overheating are to be avoided. Under these industries we find the successful drying of acetates, organic acids, inorganic salts, aniline salts, beta napthol, alkaline solutions, sulphur lime and white lead.

I. DRUG INDUSTRIES.—There is an upper limit of temperature beyond which many medicinal materials cannot be dried without causing serious decomposition. Further, there is an upper limit of temperature beyond which the intrinsic value of medicinal materials gradually decreases, although their physical properties remain unchanged. Drying in the vacuum the lowest temperature can be employed for the elimination of the included moisture, giving the best quality in such products as blood serums, pepsin, hexamethylenetramine, aspirin and phenacetine.

IV. DYE AND RUBBER INDUSTRIES.—In the dye and rubber industries large quantities of valuable solvents are used. With the vacuum apparatus these can be completely recovered. For this purpose vacuum drying apparatus are successfully employed in drying aniline oils, resorcin, organic dyes, dyestuffs, color wood extracts, sulphur black, chrome yellow, rubber, rubber substitutes and reclaimed rubber.

V. WOOD AND ALLIED INDUSTRIES.—The rapid and uniform drying of wood products, sometimes by the use of exhaust steam, makes vacuum drying the most desirable and economical. Uniform impregnation of wood products in the vacuum constitutes another feature that cannot be equalled by other kinds of apparatus. The following have been successfully dried and impregnated:—Timbers, wood products, celluloid, paper, electric apparatus, insulating materials, accumulator plates, magnetic coils and cables.

VI. LEATHER AND FELT INDUSTRIES.—The drying of leather and finished products requires the complete removal of the moisture without extracting the grease to the surface. This result can be secured quickly in the vacuum drying apparatus, as is evidenced by the successful drying of hides, pig skins, leather, shoes, felt, fur and hats.

VII. EXPLOSIVE INDUSTRIES.—The constant danger that attends the drying of high explosives, requires that it be done in the shortest time and at the lowest temperature; and in this connection it is found that the vacuum drying apparatus are the safest and most successful in such plants as smokeless powder, *trinitrotoluene, trinitroaniline and ammonium nitrate.*

To sum up: (1) That in this article the fundamental principles and advantages of vacuum drying have been clearly outlined, and these advantages would warrant a more extensive application of the vacuum process to drying problems; (2) that a brief discussion of the four more general types of vacuum drying apparatus has been made, in which their unique advantages are pointed out; (3) that the result of an investigation as to the part of vacuum drying in modern industries has been briefly discussed.

It is certain that the discussion of vacuum drying in this article does not aim to be exhaustive; on the contrary, only the first principles are discussed with a view to emphasize the supreme importance of research in modern industries. We need only remind ourselves that we are in an era of great manufacturing activity and keen competition, and that no modern industry can long prosper or even survive without giving constant attention to the improvement of its method of production and refining, and to the quality of its products.

Production and Use of Fluorspar in Japan

Fluorspar is produced in small quantities at Ishikure, in Ise province, and also at Hotatsusan, in Noto province. The domestic product is of such poor quality, however, that the greater part of the demand is supplied from foreign sources, principally Korea, Manchuria and South China. So far as can be ascertained, none is imported from the United States.

The grade used varies from CaF_2 of 50 per cent. quality, secured from Shinmaku, in Korea, to CaF_2 of 80 to 85 per cent., secured from South China. That which grades 80 per cent. or more is generally required in the local steel industry, although the Mitsubishi Co. uses a 50 per cent. grade at the Kenjiho Works. Fluorspar of 65 to 70 per cent. is utilized in the manufacture of glass and enamel ware. A certain amount is utilized at the Kamioka mine of Mitsui & Co. and also at the Osaka Electric Refinery of the Mitsubishi Co. Approximate prices c. i. f. Japanese ports are as follows: Korean, 50 per cent. quality, 12.50 yen per ton; Manchurian and Korean, 65 per cent., 25 yen per ton; South China, 80 to 85 per cent., 50 yen per ton.

The total amount of fluorspar used in the Japanese steel industry during 1920 was 230 metric tons.

Because of the small amount imported, flourspar is not listed separately in the Japanese trade statistics, not has it been possible to secure this information from other sources. It is probable that the total importation for all use will not exceed 300 tons, including the amounts received from Korea. Due to the depression in the steel industry and the competition of near-by producers, who are more favorably situated in regard to transportation costs, prospects are not very encouraging for the importation of the American product.

A Review of Japanese Banking

1. Development of the National Banks

BANKING in the modern sense of the word began in Japan in 1871, when the late Prince Ito returning from the United States where he had been studying business methods, proposed that the Japanese government establish a banking system like that of the national banks of the United States. His proposal was acted upon, and in 1872 the "Regulations Controlling National Banks" were promulgated. But before this first step of the government to establish banking institutions under legal restraints, there were several industries already established which bore some of the functions of the modern bank actively engaged in exchange transactions in Japan. The new regulations put an end to these institutions known as "Tsusho Kaisha" or "Kawase Kaisha" (commercial companies, or money order companies), and there was need of doing away with them so serious were their abuses of the trust reposed in them. The new regulations stated that they were promulgated "for the convenience of the people by the establishment of banks."

Banks established under these new regulations were granted the right of issue. This measure was expected to smooth out existing irregularities in the circulation of money which had been so disastrous under the old system. Actually this result was not achieved, and many abuses of the issue right became apparent, largely because of the incompleteness of the system. Only five banks were established under this law, and they were named in order of establishment the "First Bank" to the "Fifth Bank."

The regulations provided that at least 40 per cent. of the capital of the banks established under its provisions should be held in gold. This reserve was to be the guarantee of repayment of the notes issued. Unfortunately the government was in desperate financial straits, and paper money was issued in reckless fashion, and the difference in value between paper and specie soon became so great that there were "runs" on every bank practically all the time, and things finally got into such a state that the banks were unable to function at all. They were utterly without specie, there was only irredeemable paper money in circulation, and no one had the least confidence in "these banks, or the financial policy of the government behind them."

Things finally came to such a pass that in 1876 the banking regulations were reformed. This time capital was to be 80 per cent. at least, invested in the public loans, and the bonds were to be deposited with the government, which issued against them paper money of equal face value, which the banks put into circulation as loans to business enterprises. The remaining 20 per cent. of bank capital was to be held in gold in the bank's vaults, and not put into circulation. Notes could be redeemed in new notes, there was no obligation of specie redemption.

The immediate result of this change in regulations was to popularize the establishment of national banks. The restrictions on issue were practically all removed, and the result was to increase the amount of paper money in circulation till it became a veritable flood. There were too many banks all issuing notes, and it did not take the government long to see that the condition of affairs was worse than it had ever been before. So in December 1877 the regulations again changed.

The new regulations provided that the amount of the capital of a bank, and the amount of notes is might issue, must be first approved and licensed by the ministry of finance. But this proved an inefficient measure, and it was necessary to change the laws again the following year, 1878. This time the total amount of notes that all the banks might issue was limited to Y.34,420,000 (more or less by a small amount). At that time there were exactly 153 national banks in operation, and their total note issue was about Y.34,000,000. The law provided that no new banks could be established under the national banking laws, and this closed the period of the development of national banks, which had lasted from 1872-1879.

2. Ordinary Banks Spring Up

After 1879 ordinary banks, similar to present day institutions began to make their appearance in the financial organization. Even before 1879 there were a few important companies carrying on such usual banking operations as receiving deposits, making loans and engaging in exchange transactions, notably the Mitsui Gumi Ginko, (Mitsui Association Bank). But under the cloak of the law there was still no place for the activities of these ordinary banks. The first of these "Ordinary Banks" (Futsu-Ginko) was licensed in 1877 when the regulations were changed, by the Mitsui Gumi, under the name of the Mitsui Ginko (Mitsui Bank). Very few other similar banks were established, the National Bank was too popular with investors to attract much notice at that time. In 1879 when the national banks were at the zenith of their prosperity and popularity, the ordinary banks slowly began to appear. In 1880, thirty-nine ordinary banks were established, and in this year the Yokohama Specie Bank was organized.

The Yokohama Specie Bank was organized to assist in effecting some harmonization between foreign and domestic exchange. Foreign trade had been growing year after year, but the awful condition of the national currency was disastrously affecting its steady and healthy progress. In December 1879 the Specie Bank was licensed to begin business with a capital of Y.3,000,000. One million yen of this was deposited with the government in gold, and of the balance of Y.2,000,000, Y.400,000 was deposited in silver, and the rest of the capital Y.1,600,000 was paid up in paper. One of the principal objects of this bank was to keep silver exchange from the violent fluctuations which were disorganizing trade. It was confidently expected that his bank would succeed in bringing about a decrease in the exchange value of silver.

3. Establishment of the Nihon Ginko (Bank of Japan)

During the time between the first authorization of the national banks and the establishment of the first ordinary banks there was a great development of banks in Japan. But banks were really a new kind of business in Japan, and the system authorized by the government was not particularly suitable to Japanese peculiar conditions. The system adopted was only a copy of those abroad, and consequently there were many places where it did not fit into Japanese conditions at all. This was the reason that the issue of paper money was so recklessly increased, and it was only as the great gulf between specie and paper opened wider every day with its detrimental effect on the national commerce that it became evident that something must be done before the nation went to stark ruin. Prices rose, and rates of interest advanced to such a figure that the evils of the time were almost more than the nation could bear.

The government sought about for any suitable means of relieving the situation, and it was the late Prince Ito again who resolved that the only way out of the mess was a complete stoppage of issue of inconvertible notes, and the complete redemption of, those then in circulation. Marquis Matsukata who became finance minister at that time was strongly in favor of this plan of Prince Ito's, and furthered it at every opportunity. In order to assist the government in obtaining its object, it seemed to the financiers of the time that some strong central organ of finance was absolutely essential to the success of the new scheme.

A proposal was accordingly made that a central financial organ be created to (1) smooth out the circulation of money, (2) to supply capital to the national banks, and private companies and (3) to bring about a decrease in the charges made for interest. The plan provided that when the bank was established and in operation it should assume the functions of the department of finance.

The business of discounting foreign trade bills was to be centred in this new bank. On June 27, 1882, the government promulgated the act providing for the establishment of the Nihon Ginko, and at the same time the promoters were appointed. The capital of the bank was fixed at Y.10,000,000, on half of which was to be taken up by the government, the other half open to public subscription. The shares were soon disposed of, and on October 10, 1882, the bank was opened for business.

At the beginning of business the difference between the value of papers and specie was so great that the government did not permit the new bank the right of issue. But the object of the bank being to effect a return to hard money payments the issue of inconvertible notes was gradually restricted, and the regulations governing the national banks reformed, so that eventually the issue of covertible notes was placed in the hands of the Nihon Ginko. Thus in actual use as well as in name, the Nihon Ginko became the centre of the financial world of Japan. The previously existing banks losing their rights of issue were reorganized as ordinary banks and the Nihon Ginko as the real central organ of finance soon began to supply all the funds needed in business.

In 1878 the national banks were permitted to carry on the business of savings banks, but the first known independent savings bank was not organized until 1880.

The Special Banks

In this manner the banking system of Japan was gradually developed, tried out, and adjusted to purely Japanese conditions. The principal purposes of the banks were to supply short term loans to commercial and business houses. Agriculturists and manufacturers and such other persons as required long-term loans found it very difficult to get advances needed for their enterprises. The government took cognizance of this lack in the existing system and in 1896 the Nihon Kangyo Ginko (The Hypothec Bank of Japan) was established by special law, as a semi-official bank, its purpose being to encourage the operations of industry. Co-operating with the Kangyo Ginko, in each prefecture a Noko Ginko (banks of agriculture and industry) was organized. And in this manner the Kangyo Ginko became the centre of credit for the whole nation's industry. It supplies money on long terms to industrial concerns, while the local banks of agriculture and industry lend money to develop special industries in their own localities.

In the Hokkaido industrial conditions are somewhat different from those in Japan, and it was found necessary to develop a special organ of finance for business there. So in 1899 the Hokkaido Takushoku Ginko was organized by law, its object being to encourage colonization in the Hokkaido by offering a means of obtaining funds to develop industries there.

In this manner organs of finance to supply capital to business on the security of immovable properties were developed, and money could be obtained for long terms from them at comparatively low interest. These banks are called the "Fudosan" (immovable property) Ginko, and their special function is to make needed advances of money on immovable property in order to advance the development of agricultural and manufacturing industries.

Now that ordinary commercial transactions and long-term loans were taken care of by special banks organized under official or semi-official auspices, it became apparent that it was also necessary to have some special banks to advance funds on the security of movable properties, and on bonds, and stocks. So in 1902, the Nihon Kogyo Ginko, (Japan Industrial Bank) was established by official order. Its object was to advance money on the security of valuable securities, especially on bonds and stocks. It also specialized in loans for factory building, and it was active in importing foreign capital for use in Japanese industry. It is also the first Japanese bank to undertake a trust business.

After the annexation of Formosa it was soon discovered that a special bank was needed there to handle the ever growing business transactions with the home country. The Bank of Taiwah (Formosan Bank), was accordingly established in 1900. It acts as a bank of issue in Formosa, and handles all the funds of the government general of Taiwan, lends money to individuals and companies, and in general acts as the central financial organ of Formosa. It also assists merchants to extend their operations towards the South, into the South Seas, as the Japanese call the lands lying south of Formosa.

In Korea a bank similar to the Bank of Taiwan was much needed, and in 1909, the government legally organized the Bank of Chosen, as a successor of the Dai Ichi Ginko. This bank is also a bank of issue, and it is the central financial organ of Korea. It keeps the funds of the national treasury, and the government general on deposit, and also carries on private business. Its notes have no connection with the notes of the Bank of Japan.

In the manner described the Japanese banking system has been developed during the past fifty years. Every year its operations become more complete, and its nearness to the heart of the nation's problems is generally acknowledged. Perhaps the system is not free from points of criticism, but the faults are details, and the advantages to the nations's industry are manifest in a thousand telling ways.

Trust Companies in Japan

TOKYO, October 9.—The business of the Trust Company in Japan is not quite so new as might be thought from the seeming absence of such organizations in the economic world. Before the war there were over five hundred companies registered which had the word "Shintaku" meaning "trust or confidence" in their company names, or which stated in their "Objects for Incorporation," that they undertook "trust business." All together, before the war, about Y.40,000,000 were invested in these 500 companies. In Tokyo alone there were 250 trust companies, capitalized at Y.25,000,000.

Nature of Early Companies

These early trust companies undertook the management of estates: the improvement and reclamation of land and buildings; adjustment and management of private property; took charge of investments; settled accounts for companies and private persons; made loans on real property and buildings, or lent money on credit and also acted as loan brokers. On occasions they bought and sold land, and engaged in any kind of commission transactions in commercial goods. Most of them were, however, only a sort of building and loan association, which sold homes on the instalment plan. They also sold bonds and shares on the instalment plan. Many of them acted as trustees and custodians, and some of them were merely bill collectors.

In these many ways these "trust" companies suddenly sprang up all over the place before 1914, and they all seemed to be very active and prosperous. But looked at with a critical eye most of them were really only engaged in selling bonds and shares on monthly instalments, or acted as mutual credit associations. Many of them carried on very fraudulent business indeed, and money entrusted to them for any purpose was squandered recklessly in hopelessly incompetent industries.

There were, of course, everal real trust companies among all these concerns. These companies really acted as loan brokers. They borrowed money from many persons and lent to a favored few. It is very simple to issue loan certificates to many persons for money lent for a seeming purpose, but it is not easy to divide security up amongst the lenders. So loan certificates became popular with such companies, and they held the security for the loans themselves.

The trust companies were responsible for the securities, they approved them, and accepted them, as collateral for issuance of their own loan certificates. This was all very well when there really was care and attention shown to the class of security accepted, but more often than not, the security was valueless, and the borrower was a friend of the trust company. The holders of the loan certificates were calmly swindled out of their money.

Banks as Trust Companies

In 1906, a law was promulgated regulating the operations of companies issuing trust debentures against securities. But the operation of the law was confined to companies with more than Y.1,000,000 capital. Other trust companies with less than one million capital were prohibited from issuing these debentures, and were practically confined to carrying on a sort of banking business. As a matter of fact, before the war the only real trust companies in all Japan were a few of the great banks, the Nippon Kogyo Ginko, the Mitsui Ginko, the Yasuda Ginko, the Dai Hyaku Ginko and the Dai Sanju Shi Ginko. Other companies were only "trust companies" in name, and their business in amount, was more or less than nothing at all, and only a kind of "note-shaving."

War Brings Changes

After the great war, there were many great changes in the economic organization of Japan. Naturally, the trust companies were also affected. Many new industries sprang up in 1919, and they all required capital on long time terms. The banks previously had been able to meet all demands for industrial funds, but the demand after the war was so sudden and so great that the banks were unable to keep up with the demand for long-term loans and still keep mobile funds for commercial transactions. This brought the trust companies into the loan market as supplies of capital, on long-time terms, to budding and promising industrial ventures.

To meet the new demand many new trust companies were organized. The Nichi-Bei Shintaku K.K., the Nissho Shintaku K. K., the Kyosho Shintaku K. K., the Nichiro Shintaku K. K., and many others sprang up to meet the growing needs of the country for long-time loan funds.

The leader in the movement was the Bank of Taiwan, which for a time accepted "deposits on trust," for from three to five years at a higher rate of interest than the banks allowed on fixed deposits. But this was only an episode in the bank's career, and the new trust deposits were soon abandoned after a somewhat inglorious trial.

Among the many trust companies which were organized in the after-the-war boom, the Nichi-Shintaku may be taken as representative of them all. Both these companies are capitalized at Y.50,000,000 each, which is more than the total capitalization of the 50 trust companies organized before the war. From this one fact alone it can be seen what a decided advance has been made in the standing of the trust company's business during the past few years.

These new trust companies undertake all the usual business of trust companies in America and Great Britain, and add to their activities, the guaranteeing of company and personal loans. They also guarantee the rate of dividends on stocks of new companies, but this is also a part of the work of American trust companies. The two great trust companies, the Nichi-Bei Shintaku K. K., and the Kokusai Shintaku K. K., find that the greatest part of their activity is centred around the guaranteeing of loans.

Something Good

The present trust companies are beginning to fill a very definite need in the present economic organization of the country as suppliers of capital which the banks cannot lend for the long time the trust companies can consider. But in this function the trust companies really assist the banks, but even under the best of circumstances some collision of interests between the trust companies and the banks may be expected. They both solicit deposits of funds from the public. There is practically no difference between the deposits in the trust companies and the bank's fixed deposits, but it is easier for the trust companies to make long-term loans.

So, it happens that for some time past the trust companies have been more successful in getting long time deposits than the banks have been. Before the war there was not a single trust company with such an ability, but now the deposits of the Nichibei and Kokusai Shintaku Companies are very large. In order, therefore, to avoid a collision between the banks and the trust companies, the government should rewrite the laws under which trust companies operate.

New Plan Outlined

Deposits with trust companies partake of the nature of savings deposits. Banks should devote themselves exclusively to short-time current account deposits, and to discount, while trust companies should concern themselves only with long-term loans. Trust company deposits will then assume the character of real fixed deposits, and the deposits in the banks will be only temporary deposits. Banks should lend money for commercial transactions only, while the trust companies should confine their loans to industrial concerns which require long-time terms.

As things are managed in the banks to-day there will soon be a collision between them and the trust companies, so the division of the loan field should be made as soon as possible between their present conflicting interests. In this way the great banks will naturally be obliged to establish co-operating trust companies which will have the confidence of rich capitalists who will deposit their money with them for the development of the industrial organization of the country.

The trust company business in Japan is still only in its swaddling clothes and it remains to be seen what it can do if permitted to go on competing with the banks for long-time deposits. But it is necessary that the law be changed in order to avoid ruinous competition between the banks and the trust companies. The new law should provide for very complete investigation and inspection of the accounts of all trust companies, and their investments and all loans should be strictly controlled by the government.

If these things are provided for in the new law there is no doubt of the future of the trust companies. They will then become a most valuable accession to the economic world which requires a reliable organ through which funds for industrial use can be obtained on terms which banks, with their necessity of keeping their funds mobile, are unable to give without endangering the commercial interests of the nation.

The Thirteen Great Banks of Japan

THIRTEEN banks in Japan carry deposits of over Y.100,000,000 each. Eight of these are in Tokyo and five in Osaka, the former being the Mitsui Bank, Ltd., Dai Ichi Ginko, Ltd., Jugo Ginko, Ltd., Mitsubishi Ginko, Ltd., Kawasaki Ginko, Ltd., Yasuda Ginko, Ltd., Dai San Ginko, Ltd., and the Dai Hyaku Ginko, Ltd., while the Osaka banks are the Sumitomo Ginko, Ltd., 34th Bank, Ltd., Yamaguchi Ginko, Ltd., Omi Ginko, Ltd., and Kajima

Ginko, Ltd. Considering the great amount of their deposits these thirteen institutions may quite reasonably be called the "Great Banks" of Japan.

At the end of June, 1918, deposits in all the banks in Japan totaled Y.3,806,000,000, and by the end of June, 1919, this had increased to Y.5,744,000,000. This amount has not yet been exceeded, and it is doubtful if it will be exceeded in the near future if present unfavorable conditions in the business and industrial worlds continue.

The greater part of Japan's bank deposits is held by the banks forming the membership of the clearing house associations in the great commercial centres, as is clearly shown by the following figures :—

	Total Deposits Whole Country	Deposits in Clearing House Banks
	Yen	Yen
1918, June 30 ..	3,806,533,000	3,496,974,000
Dec. 31 ..	4,639,315,000	4,307,961,000
1919, June 30 ..	5,192,938,000	4,607,067,000
Dec. 31 ..	5,744,097,000	4,975,596,000
1920, June 30 ..	Unknown	4,866,251,000
Dec. 31 ..	Unknown	4,811,190,000
1921, June 30 ..	Unknown	5,101,000,000

(*Note.*—Some of the exchange banks have not reported their deposits of June 30, 1921, so the 1921 figure is an estimate.)

Clearing house associations exist in Tokyo, Osaka, Kobe, Kyoto, Yokohama Nagoya, Hiroshima, Shimonoseki, Moji, Kanazawa, Hakodate, Otaru, Sapporo and Fukuoka, seventeen cities in all, covering every important commercial district from north to south.

On December 31, 1918, about ninety-five per cent. of the bank deposits of the country were held in the clearing house banks, but on December 31, 1919, they held only eighty-seven per cent. By June 30, 1920, their deposits had increased by Y.111,000,000 ; the end of the year showed a decrease of half this amount, but again by June 30, 1921, an increase of Y.290,000,000 had been made in their deposits. These thirteen banks have weathered the panic of 1920 in a manner inspiring the ordinary bank depositor with confidence. As a natural result of this confidence in the clearing house banks their deposits are steadily increasing in the present trying times. The greater part of the deposits shown in the first table are held by the 13 great banks. On Jnne 30, 1919, they held Y.2,934,000,000, on December 31, 1919, Y.2,915,000,000, and on June 30, 1920, about Y.3,000,000,000, out of Y.4,866,251,000, representing the total deposits in all clearing house banks in all Japan. In other words sixty per cent. was held by the Great Thirteen, and they hold more than fifty per cent. of the deposits of the whole country. This is an extraordinary state of affairs.

At the end of June, 1921, the Mitsui Bank carried the largest deposits, and the Dai Hyaku Ginko the smallest of the eight of the Great Thirteen in Tokyo. In Osaka the Sumitomo Bank held the most and the Kajima Bank the least. In order of amounts of deposits held these thirteen institutions rank as follows :—

1. Mitsui Ginko, Ltd.
2. Dai Ichi Ginko, Ltd.(First Bank).
3. Jugo Ginko, Ltd. (Fifteenth Bank).
4. Sumitomo Ginko, Ltd.
5. Mitsubishi Ginko, Ltd.
6. The San Ju Shi Ginko, Ltd. (Thirty-Fourth Bank).
7. Yamaguchi Ginko, Ltd.
8. Kawasaki Ginko, Ltd.
9. Yasuda Ginko, Ltd.
10. Omi Ginko, Ltd.
11. Kajima Ginko, Ltd.
12. Dai San Ginko, Ltd. (Third Bank).
13. Dai Hyaku Ginko, Ltd. (Hundredth Bank).

Deposits in these thirteen banks in Tokyo and Osaka during 1920 and to the end of June, 1921, were as follows :

	June 30, 1920.	Dec. 31, 1920.	June 30. 1921.
Tokyo.	Yen	Yen	Yen
Mtsui Bank	412,188,000	424,702,000	413,194,000
Dai Ichi Ginko ..	380,134,000	377,363,000	390,356,000
Jugo Ginko	344,099,000	339,609,000	357,885,000
Mitsubishi Ginko ..	270,100,000	264,550,000	264,550,000
Kawasaki Ginko ..	161,442,000	165,876,000	173,469,000
Yasuda Ginko ..	128,877,000	150,174,000	150,228,000
Dai San Ginko ..	132,460,000	134,916,000	138,902,000
Dai Hyaku Ginko ..	122,919,000	106,274,000	110,740,000
Total	Y.1,952,215,000	Y.1,963,462,000	Y.1,999,324,000

(*Note.*—The Kawasaki Bank of Kobe, and the Jugo Ginko of Tokyo were amalgamated after July 1, 1920 ; the volume of deposits for June 30, 1920, is therefore their combined deposits on that date. The Mitsuibishi and Sumitomo Banks have not yet published their reports for the first half-year of 1921, so the deposits for December 31, 1920, are repeated in the 1921 column.)

	June 30, 1920.	Dec. 31, 1920.	June 30, 1921.
Osaka.	Yen	Yen	Yen
Sumitomo Ginko ..	359,764,000	315,441,000	315,441,000
Dai San Ju Shi Ginko	194,457,000	193,677,000	209,523,000
Yamaguchi Ginko ..	182,860,000	182,221,000	186,685,000
Omi Ginko	125,478,000	132,939,000	145,695,000
Kajima Ginko ..	119,451,000	127,644,000	140,523,000
Total ..	Y.981,830,000	Y.951,922,000	Y:995,867,000
Grand Total	Y.2,934,049,000	Y.2,915,384,000	Y.2,995,191,000

Before the war the Dai Hyaku Ginko, Ltd., occupied a position about midway on the list of the great banks, but it has now fallen to the last place on the list.

The greatest deposits in this list are held by the Mitsubishi Bank, Dai Ichi Ginko, Ltd., Jugo Ginko, Ltd., Sumitomo Ginko, Ltd., and Mitsubishi Ginko, Ltd. These are called the "Great Banks" of the first rank. The second rank is composed of the Dai San Ju Shi Ginko, Ltd., Yamaguchi Ginko, Ltd., Kawasaki Ginko, Ltd., Yasuda Ginko, Ltd., Omi Ginko, Ltd., Kajima Ginko, Ltd., Dai San Ginko Ltd., and Dai Hyaku Ginko, Ltd. The lowest deposits total of first rank institutions is that of the Mitsubishi Ginko, and in the second rank the Dai San Ju Shi Ginko comes first. Between the banks of the first and those of the second rank there is a difference in deposits of about Y.60,000,000, so the line may well be drawn where it is. Nevertheless the difference in deposits between the Sumitomo Ginko, the next to the last on the list of the first rank, and the Mitsubishi Ginko, the last on the first rank list, is over Y.50,000,000, so the Mitsubishi Ginko may be said to occupy a position midway between the great banks of the first rank and those of the second rank.

Many factors determine the amount of deposits which these banks carry. All are strongly established in the confidence of the public, and it appears that the amount of each bank's capital, its system of branch offices which tap the resource centres of the country, and the number of its correspondents all have a profound effect on the volume of its deposits. Nevertheless in the present condition of business, and even banking, no great extension of business may be hoped for by increasing capital, or extending branch offices and the number of correspondents of any of these banks. The figures given will show some slight hint of present banking conditions and their potentialities.

Perhaps the outstanding feature is the greater financial importance of Tokyo's banks as compared with those of Osaka. Undoubtedly the capital is the financial centre of Japan, even though Osaka occupies a similar position in respect to the business and industrial life of the Japanese nation.

Defects of Present Banking System of Japan

THE central bank of Japan is the Nihon Ginko, the bank for banks. Its principal function is to regulate the circulation of money. At the same time it is the bank of the nation, it floats the national bond issues, and manages the funds of the national treasury, and has the right of issuing convertible notes. To a certain degree it harmonizes the currency as it is the leader and controller of the financial world. In times of depression or panic it expresses its opinion of the state of the nation, and in times of danger, or alarm it can control business by changing its interest rates. Often when there is a state of reaction in the financial world and private banks show signs of instability the Nihon Ginko will come to its aid, and advance the funds necessary to keep it afloat.

After the war the financial world became very active and eccentricity rules its activities. Speculation filled the thoughts of men and controlled operations in business and finance. In 1919, once in October and again in December, the Bank of Japan raised its interest rate 2 rin a day per hundred yen (about ¾ per cent. a year). This brought the financial world up in its course in great alarm, but the effect of the advance in interest was too slight, and eventually it had little effect on the financial world.

Up to March 1920, business expanded in an unhealthy, unnatural manner, under the driving force of unlimited speculation. The smash came on March 15, 1920, when the share market was obliged to suspend transactions for a few days in order to adjust accounts after a big break in the prices of all shares. The world of finance was not able to recover from this shock, and the great reaction of April, 1920, finally shook the business world almost to pieces. At the time of greatest crisis the Bank of Japan advanced a large part of its frunds on shares, cotton yarn, sugar and raw silk in order to relieve the intolerable conditions the panic revealed. It also deposited some of its funds in other banks and thus enabled them to weather the storm which beat about them. In this way the Bank of Japan faithfully observed its duties as the central bank of the nation. However, it was unable to advance money on company shares, and commercial bills. Its transactions in the panic time were limited to advances on bank security, personal transactions were very few indeeed. Consequently its functions as a central bank are not complete, and its defects were exhibited at the time of the panic.

The special banks, the Yokohama Specie Bank, the Nihon Kangyo Ginko, the Nihon Kogyo Ginko and the Noko Ginko, the Hokkaido Takushoku Ginko, the Taiwan and Chosen Ginko, and the Chosen Shokusan Ginko, all have no connection with the organization and functions of the Nihon Ginko. There is little connection between the government and these banks, although at first glance there seems to be a very close relationship between their activities and the government.

The Kangyo Ginko and the Kogyo Ginko were first established to serve different ends. The Kangyo Ginko was to regulate the supply of funds to the country districts, and to supply capital for industrial enterprises, and to act as a central organ for the Noko Ginko of each prefecture. It made loans against immovable property, and the factories of legal corporations, in the towns and cities.

The Kogyo Ginko was to provide funds for loans against valuable securities, against bonds, and shares. But in recent years it has made its principal business lending money to factories and manufacturing companies. The position of the Kogyo and the Kangyo Banks is thus becoming the same, because they are both acting as organs for providing funds for industrial purposes only.

A recent law permitted the amalgamation of the prefectural Noko Ginko with the Kangyo Ginko, and revised the regulations governing its activities, so that the funds raised by the issues of its premium bonds might only be employed in loans for the public benefit not for individual enterprises. But at the same time it is permitted to make loans on immovable property and on factory equipments, by the issue of ordinary bonds, which, however, are only to be made on city property. In this particular the function of the Kangyo and the Kogyo banks are similar. The Kogyo Ginko does not make loans on country property, and the Kangyo does not lend money on bonds and shares. In this alone are they different.

In recent years a supply of funds for industrial purposes has become more and more necessary, so the Kangyo Ginko and the Kogyo Ginko have in great part adopted the same course of business. In fact there is no reason for not making their business one: perhaps this will be the next advance in the Japanese banking system.

The Banks of Chosen and Taiwan

These banks were established because the conditions of money circulation in the colonies were very different from what they were in the home country. Another reason for their establishment is found in the government's fear that the circulation of the notes of the Bank of Japan in the colonies would not be unattended with anxieties, in the existing state of feeling towards Japanese annexation.

To-day conditions have materially altered. In the beginnings of Japanese occupation business conditions were unsettled, now they are stabilized, and the notes of the Bank of Japan are as well known as the notes of the native banks. The arguments that the nation would sustain great loss in the event of rebellion no longer hold good when rebellion is unthinkable, and the right of issue held by the Banks of Chosen and Taiwan is now a remnant of times gone past. The right of issue held by the colonial banks no longer being essential to the development of the colonies the government is preparing to rescind the right and replace the notes in circulation with those of the Nihon Bank. Of course, business conditions in Taiwan and in Chosen, do not always follow along with conditions in Japan, so it is a real convenience to have the Banks of Taiwan and of Chosen. But the right of issue is no longer necessary to them, and it should be withdrawn. The best solution of the issue right would be to amalgamate the two colonial banks into one central colonial bank with close connection with the Bank of Japan.

The Futsu Ginko

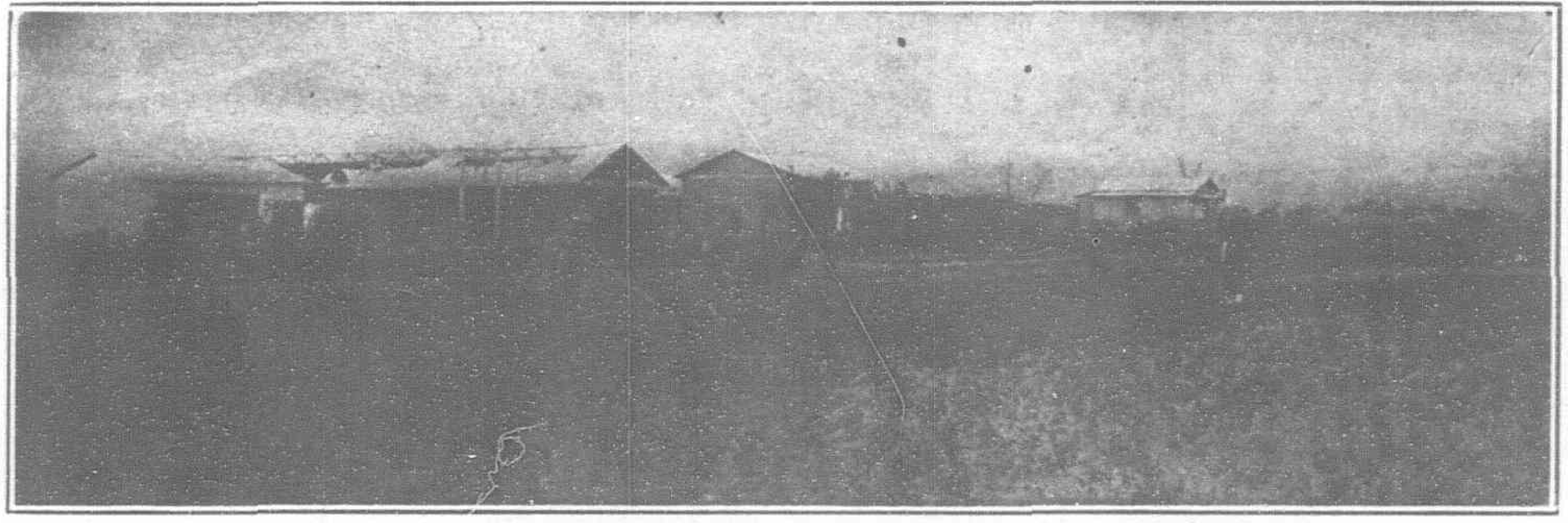
These banks have developed well without any protection or assistance from the government. But if one is to speak of the weak point of the banking system of Japan, it is to be found in the too great number of small "futsu Ginko" which constitute a real peril to the Japanese financial world. There is no connection between them, and when conditions of finance are good they lend money in a most extravagant careless manner on any kind of security, and so when conditions get a bit upset, or tight, they feverishly call in their loans, and consequently they contribute to make the waves of prosperity and loss vary too greatly in either direction. This is the greatest evil confronting the Japanese banking world, and it is caused by the mass of little banks which do not act together with the nation's great banks to maintain a normal level of prosperity.

Another great evil is that these small bankers are devoid of any settled opinion about money matters. This present big reaction is largely due to the action of these irresponsible bankers. The recent tendency to amalgamate the minor banking interests is a decidedly good one, which should advance the power and influence of the important bankers, and help to stabilize the opinion of Japanese finance in the eyes of the rest of the world.

Japan's Chartered Company

WHEN Japan undertook the task of developing Korea its government followed the precedent created by Great Britain and organized a semi-official chartered company to carry out the work. The Oriental Development Company, Ltd., was established in December, 1908, with a capital of Y.10,000,000, of which Y.3,000,000 was taken up by the government, its statutes providing rigid official supervision over its operation. The government furthermore furnished a subsidy of Y.300,000 for each of the first eight years, which is to be repaid out of excess profits when dividends exceed ten per cent.

The company started work early in 1909, not long before the formal incorporation of Korea in the Japanese empire, an event which doubtless accelerated the company's progress. The program of the undertaking was largely that of a bank making advances to settlers, to groups of farmers and on produce on the way to market. All such loans were repayable by instalments extending over various terms of years—in the case of produce within one year. Loans could also be made on real property, railways and mining concessions, to public corporations and industrial associations, and on the security of shares and debentures of companies engaged in dealing with emigrants, and in development work. Up to 1916, when the company confined its operations to Korea, the average amount of the loans made was small, and, indeed, had a declining tendency, the average falling from Y.5,835 in 1912 to Y.2,803 four years later.



Offices of Oriental Development Company at Seoul, Korea

Then came a revolutionary change in the scope of the Oriental Development Company, for in 1917 the statutes were revised to permit operations in foreign countries. Branches were opened at Mukden and Dairen in that year; in 1919 Kharbin and Tsingtao (formerly German) saw branches established. The company contemplates, if it has not already done so, the establishment of branches in some of the South Sea islands and in New York. The Philippines, Sumatra, Java, Borneo and even New Guinea are included in its potential sphere of operations. A curious fact emerges from the record of the company's achievements recently published in English at Tokyo. Under the influence of war demand for products the average of loans in Korea expanded, but still was modest in comparison with those made in the more distant spheres of operations. In 1917 four-fifths of the loans were made in Korea with an average per loan of Y.4,000, but the Mukden branch had an average of 18,300 and the Dalny (Port Arthur) branch one of Y.8,860. By 1918 the aggregate of loans in Korea had fallen to 56 per cent. of the total advances, and their average was just under Y.5,000, against Y.26,600 for Mukden and Y.8,700 for Dalny.

By 1919 the operations had so far changed their character that of Y.70,257,000 advanced only Y.32,595,500 were lent in Korea, where the average loan had declined to Y.4,700, against Y.37,200 for the Mukden branch, 15,500 for Dalny, 54,500 for Kharbin and 52,600 for Tsingtao. Nine loans attributed to the Tokyo head office give an average of Y.336,800 per loan, Agricultural development still claimed the largest proportion of the 1919 loans, though mining and industries begin to bulk more largely, and transport and communications account for a rapidly expanding sum. It may be presumed that the substantial amount of Y.19,806,200, described as for "streets laying," relates to roads, otherwise it would appear that an organization designed for rural development was paying too much attention to urban facilities. In any case it is evident that the company originally intended to fulfil the duty of assisting production in Korea has increasingly become an instrument for developments in Manchuria, Mongolia and China, which since Europe went to war have had to depend more and more on Japanese capital and enterprise for their advancement.

The extent of lands in Korea in possession of the company which is regarded as constituting its most important asset is 278,000 *chobu* and upwards. It consists of paddy fields for 51,150 *chobu*, upland farm for 20,145 *chobu*, forests for 3,873 *chobu*, residential land for 107,700 *chobu* and lands unclassified for 3,331 *chobu*. Besides the company holds on lease state forests for more than 30,000 *chobu*, the ownership of which is to fall into the hands of the company gratis when it has succeeded in the afforestation. The actual value of all these lands must be not less than Y.70,000,000. Besides, since last year the company has acquired lands and buildings to a considerable extent in China. To give the principal instances, it purchased lands and buildings worth Y.1,700,000 in Tsingtao which had been in the possession of Germans under the control of the Chinese government. With these new acquirements the company started an industrial concern. In Tientsin it purchased similar real estate to the value of Y.700,000 and upwards and opened a sister company therewith. In the same place, or Tientsin the company is to shortly purchase another land and buildings amounting to Y.800,000, approximately.

Japanese Life Insurance Business

AT the end of June, 1921, Japanese life insurance companies had outstanding 3,920,000 policies, for insurance amounting to Y.2,873,000,000. Compared to 1913 the number of policies has increased 200 per cent. and the value of the insurance issued, three hundred per cent.

The course of the life insurance business since 1913 (3) is shown in the following table:—

	Policies Issued.	Insurance Value.
		Yen
1913	1,688,683	963,311,000
1914	1,862,369	1,085,083,000
1915	1,816,239	1,072,225,000
1916	1,849,725	1,130,344,000
1917	2,355,365	1,366,394,000
1918	2,740,100	1,679,605,000
1919	3,328,134	2,222,126,000
1920	3,753,747	2,684,188,000
1921, June 30	3,920,000	2,873,218,000

The Japanese people were slow in grasping the value of life insurance when it was first introduced to them. During the years under review, however, the constant efforts of the established life insurance companies, and a growth of the idea that the companies were reliable and actually would perform the promises they made, stimulated activity in life insurance circles, and the number and value of policies issued has most noticeably increased year after year.

Principally important is the increase in insurance issued, during and after the great war, as an effect of the good conditions existing in the financial world. The growth was able to withstand even the panic shock of 1920, and business was but little affected by the depression. However, the influence of the panic is now slowly being felt in a general inactivity in life insurance, particularly noticeable from the number of policies which have been allowed to lapse during the past year.

During the first half of 1920 when the effect of the panic was most severe, 80,000 policies valued at Y.57,000,000 were allowed to lapse. In the second half-year, when things were slowly settling down after the great shake-up, 177 policies valued at $140,000,000 lapsed; a total for the year of 257,000 policies valued at Y.197,900,000.

This year during the period from January 1st to June 30th, 136,000 policies valued at Y.117,681,000 have already lapsed. This is a very large number, particularly noticeable as such when it is considered that adjustments of policies are made on the company's books at the end of the year, and consequently it may be expected that from July to the end of this year the number of lapsed policies will be much greater than during the first half already reported. Bad financial and industrial conditions are gradually making themselves felt in a gradual oppression of all walks of life in Japan, and life insurance is no exception to the rule, for its figures of business show the condition most pointedly.

During the past seven years the number of policies which have lapsed and their value, is shown in the following table :—

	No. of policies lapsed.	Value of policies lapsed. Yen
1915	294,118	192,874,000
1916	249,252	161,171,000
1917	189,392	129,541,000
1918	156,434	112,242,000
1919	154,752	122,350,000
1920	257,614	197,936,000
1921, June 30 ..	136,639	117,681,000

Naturally, with so many policies lapsing the life insurance companies are obliged to put forth unusual efforts to hold up the amount of business they carry.

New contracts issued during the last seven years were :—

	New Policies.	New Insurance Issued. Yen
1915	267,267	191,840,000
1916	301,583	229,799,000
1917	379,409	300,783,000
1918	488,394	412,278,000
1919	666,209	613,534,000
1920	725,955	685,756,000
1921, June 30 ..	312,776	314,514,000

Under the necessity of increasing their efforts to get new insurance all the companies have been obliged to increase their advertising expenses, and the cost of soliciting has also greatly increased during the past two years. It is not at all easy to decrease these expenses because of the loss of new business it would entail, consequently under conditions existing in the financial and industrial worlds the future of life insurance companies is not considered to be very bright.

Last year, from January to June, the average face value of each new policy issued, was Y.1,006. All the companies are seeking large policy-holders, because it costs them no more to sell large amounts of insurance in one policy than it does to sell a policy for a small sum. But the large policy-holders are allowing their insurance to lapse, and the companies are finding it increasingly difficult to get such insurance. About the largest amount of insurance written by any Japanese company on the life of one man is Y.600,000. There are many policies of Y.100,000 and Y.150,000, written on the lives of some of the most prominent business men of Japan. But compared with the use of life insurance by the big business men of the United States, that particular phase of life insurance in Japan is still in its swaddling clothes.

Since 1916 the government's insurance without physical examination, "kani hoken," has increased the amount for which the average company policy is issued. The government's maximum policy is for Y.250. Premiums are very low, and are payable monthly, and the result has been to take practically all insurance for petty amounts away from the insurance companies, who are not unwilling to see it leave them.

Since 1916, the companies have been able to turn their attention to large amount policies. During the last five years the value of single policies issued has therefore greatly increased. Recently, however, the number of big policies has greatly decreased, as a result of the panic, but even with this set-back the average amount of each policy has increased.

The average value of lapsed policies this year was Y.861, which is a hundred yen greater per policy than last year. Many policies for big amounts have been allowed to lapse during the past nine months, which have been months of the greatest strain and anxiety to many prominent business men and financiers, whom only the direst necessity could have driven to this desperate means of cutting down expenses.

The average value of new policies issued and the average value of policies lapsed for the past seven years are shown in the following table :—

	Average New Policies Yen	Average Lapsed Policies. Yen
1915	718.00	651.00
1916	762.00	647.00
1917	793.00	684.00
1918	829.00	718.00
1919	922.00	791.00
1920	945.00	769.00
1921, June 30 ..	1,006.00	861.00

When the effects of the panic began to be felt in the life insurance world many companies began to reduce their staffs and discharge solicitors. But they are now beginning to regret their scary attitude. Those companies who continued strenuous efforts to get business have been those which have written the most insurance during the past six months, while many companies of previous high standing have lost so much business from lapses and failures to get new policies that their position is highly endangered to-day.

Small companies not particularly active before the panic broke were the most badly hit by the slump. But the big companies have now all gone through the re-adjustment period up to date with colors still flying, even if for some of them those colors are slightly bedraggled.

The latest statistics concerning China's mineral output show that, while that country covers about 7 per cent. of the earth's surface, and has a population equal to a quarter of the whole globe, the mineral production is less than 1 per cent. Out of thirty-two substances enumerated, only antimony and tungsten are above 10 per cent.; tin and mercury above 5 per cent.; zinc, arsenic, coal, asbestos, magnesite and talc above 1 per cent. Substances of fundamental importance to national industry, such as iron, copper, petroleum and sulphur are very insignificant in amount, whilst phosphates, nitrates and potash, so necessary to modern agriculture, have not yet been found in any quantity.

Banking in Korea

By T. HOSHINO

FINANCIAL reforms in Chosen began with the engagement by the Korean government in 1904 of a Japanese financial adviser, and, in a strict sense, may be said to have been finished only with the recent completion of the land surveying work which furnished the government with a true and reliable basis for the taxation of land, which tax constitutes the greatest item of the Korean revenue. Meanwhile Chosen proved no light burden upon the treasury of Japan. During the protectorate régimé large sums of money were defrayed by the imperial treasury of Japan for the maintenance of the residency-general and its affiliated offices, railways, postal, telegraphic and other communication facilities, etc., in addition to naval and military expenses, and the meeting of the deficit in the annual revenue of the Korean government. With the transfer of judicial administration and prisons to the Japanese government in 1909, the maintenance of the law courts and prisons also devolved upon the imperial treasury. The sums thus disbursed by Japan were Y.27,000,000 for the fiscal year 1907, Y.31,000,000 for 1908, Y.21,000,000 for 1909 and Y.25,000,000 for 1910, the last-named including expenses incidental on the annexation. With the annexation the complex system of government was changed into a simpler and more unified one, thus curtailing administrative expenses. A special account of the government-general was established, and by it all government expenses in Chosen were to be met by taxes and receipts collected in the country, and the deficit, if any, made good by the imperial treasury of Japan. During the ten years following there has always been some deficit to be made good by Japan, but so satisfactory has been the progress made in the public finances of Chosen that in a few years no subsidy will be needed to make both ends meet. The satisfactory development of the finances of Chosen will be made clear by the following table, in which the estimates of revenue and expenditure for the past ten years are compared :—

Year	Revenue		
	Ordinary Yen	Extraordinary Yen	Total Yen
1910-11	11,953,272	10,368,475	22,321,747
1911-12	25,564,176	26,720,288	52,284,464
1912-13	28,764,740	33,362,154	62,126,894
1913-14	31,347,543	31,745,944	63,093,487
1914-15	35,692,238	26,355,422	62,047,660
1915-16	38,829,330	23,893,165	62,722,495
1916-17	44,764,559	23,437,548	68,202,107
1917-18	46,433,567	28,469,829	74,903,396
1918-19	42,668,220	22,473,433	65,141,653
1919-20	52,642,608	24,918,082	77,560,690

Year	Expenditure			Subsidy from Japan Yen
	Ordinary Yen	Extra-ordinary Yen	Total Yen	
1910-11	9,916,993	8,340,390	18,257,383	2,885,000
1911-12	25,561,053	20,611,257	46,172,310	12,350,000
1912-13	28,000,278	23,780,946	51,781,224	12,350,000
1913-14	31,690,220	21,764,264	53,454,484	10,000,000
1914-15	32,277,749	22,822,085	55,099,834	9,000,000
1915-16	34,724,853	22,145,094	56,869,947	8,000,000
1916-17	36,188,619	21,374,091	57,562,710	7,000,000
1917-18	31,944,360	19,227,466	51,171,826	5,000,000
1918-19	36,399,704	28,741,949	65,141,653	3,000,000
1919-20	39,698,250	37,862,440	77,560,690	?

Expansion of Financial Market.—Along with the commercial and tradal expansion, the financial market of the peninsula has also greatly broadened. Its relation with Japan has become inseparable, and that with Manchuria is constantly growing closer. Every fluctuation in the money market in Japan is reflected in that of the peninsula, and money is moving with the utmost freedom between the two countries. This is quite natural, since most of the large commercial banks doing business in the peninsula are branches of Japanese banks with the exception of the Bank of Chosen, which, on the other hand, maintains four branches in Japan and transacts a very large business through them, as we shall see later on. On the whole, however, capital comes from across the channel, the truth of which statement may be gathered from the various tables given in the preceding chapter respecting Japanese enterprises in the peninsula, and this influx of capital will increase as the financial power of Japan grows and the natural resources of the peninsula become known to the capitalists at home. The financial relation of the country with Manchuria is the reverse of that with Japan. Money flows out to that country to help develop the great natural wealth it has in store. The chief intermediary in this movement of capital is the Bank of Chosen. In a word, the Bank of Chosen introduces capital from Japan, invests part in Chosen, and employs the rest in Manchuria. The Oriental Development Company, which, though it removed its head office to Tokyo a few months ago, may still be called a Korean company, is pursuing much the same line though on a smaller scale. A large number of other institutions and individual merchants keep offices in both countries, and the ever-increasing business transactions between the two countries are uniting the money markets of both into one great economic community. The fact is the Yalu does not separate the Japanese empire and the Chinese republic so effectively economically as it does politically. To the enterprising, Chosen has proved too small a field, they push on to Manchuria and build up there an economic tie, the like of which is rarely found between two distinct self-governing nations. There is no question either that the prevalence of the Bank of Chosen notes outside the boundaries of Chosen, especially in Manchuria, has contributed to no small extent to this broadening of Chosen's financial relation abroad. In connection with this financial inter-relationship between Chosen, Manchuria and Japan, the following table, giving deposits and advances by the Bank of Chosen in the three countries, will be interesting :—

Year	Chosen Offices Yen	Index No.	Manchurian Offices Yen	Index No.
1910	5,470,415	100	442,516	100
1911	5,905,463	108	471,231	106
1912	13,244,707	242	797,938	182
1913	18,650,968	341	749,156	169
1914	16,055,199	294	1,063,626	240
1915	15,781,898	289	2,084,639	471
1916	17,288,089	316	9,107,316	2,058
1917	20,923,336	382	12,338,345	2,788
1918	31,830,760	582	31,569,073	7,156
1919	38,058,360	696	44,555,475	10,069

Year	Japanese Offices Yen	Index Number	Total Yen	Index No.
1910	47,720	100	5,960,651	100
1911	601,587	1,261	6,978,281	117
1912	127,233	267	14,169,878	238
1913	1,401,802	2,938	20,801,926	349
1914	479,679	1,005	17,598,504	259
1915	722,063	1,513	18,588,600	312
1916	6,638,003	13,910	33,033,408	554
1917	54,690,047	114,606	87,951,726	1,475
1918	146,507,508	307,015	209,907,341	3,521
1919	88,069,490	184,555	170,683,325	2,863

Year	Chosen Offices Yen	Index No.	Manchurian Offices Yen	Index No.
1910	20,125,422	100	134,294	100
1911	20,936,352	104	126,576	94
1912	30,932,585	153	277,216	206

Year	Chosen Offices	Index No.	Manchurian Offices	Index No.
	Yen		Yen	
1913	32,369,242	161	2,550,531	1,899
1914	31,748,900	158	3,308,004	2,463
1915	30,210,422	150	3,681,808	2,744
1916	35,650,426	177	17,010,279	12,665
1917	49,445,650	246	24,299,701	18,094
1918	65,579,266	329	70,640,308	52,601
1919	121,228,886	602	115,760,106	86,199

Year	Japanese Offices	Index No.	Total	Index No.
	Yen		Yen	
1910	1,778,572	100	22,038,288	100
1911	834,682	47	21,897,610	99
1912	1,296,590	73	32,506,391	148
1913	2,612,884	147	37,532,657	170
1914	2,019,109	114	37,076,013	168
1915	8,970,271	505	42,862,501	194
1916	8,968,696	504	61,629,401	280
1917	51,164,429	2,882	124,909,780	567
1918	136,546,846	7,677	272,766,423	1,238
1919	157,159,034	8,382	394,148,026	1,788

Expansion of Currency.—The financial market of Chosen has greatly enlarged its sphere of late, the proof of which may be seen in the volume of currencies in circulation, and the amount of the cheques cleared through the four clearing-houses in the country. The increase in the currency is shown in the following table:

Year	Japanese Currency	Bank of Chosen Notes*	Korean Coins		Total	Index No.
			New Coins	*Yupchun*		
	Yen	Yen	Yen	Yen	Yen	
1910 ...	553,476	20,163,900	8,215,785	2,415,288	31,348,459	100
1911 ...	3,619,792	25,006,540	4,947,826	1,573,167	35,147,325	112
1912 ...	4,536,528	25,550,400	3,998,036	1,099,700	35,184,664	112
1913 ...	4,438,167	25,693,260	3,020,124	663,266	33,814,817	107
1914 ...	5,056,221	21,850,370	2,318,233	379,916	29,504,740	94
1915 ...	5,457,359	34,387,520	2,028,848	212,631	42,086,358	134
1916 ...	5,490,386	46,627,080	1,913,320	132,971	54,163,757	173
1917 ...	6,219,125	67,364,950	1,905,099	119,522	75,603,696	241
1918 ...	8,417,610	115,523,671	1,904,305	118,078	125,957,664	401

Remarks: * This being the total issue of the note part is in circulation in Manchuria.

The fluctuations noticeable in the table have been due to a great variety of causes; at one time the import-excess, mentioned before, greatly contracted the currency, while, at other times, especially during the past few years, wartime conditions greatly inflated it. On the whole, however, the currency has expanded through the economic development of the country, which fact is further shown by the amount of the cheques cleared through the clearing-houses in Seoul, Fusan, Chemulpo and Pyeng-yang, the only clearing-houses as yet in the country.

Year	Seoul		Chemulpo	
	No. of Cheques	Amount Cleared	No. of Cheques	Amount Cleared
		1,000 yen		1,000 yen
1910	59,416	20,490	—	—
1911	167,050	50,527	21,921	9,413
1912	217,727	63,623	26,702	13,698
1913	260,212	64,533	35,413	15,126
1914	284,396	57,331	40,126	13,740
1915	307,061	57,912	42,849	15,874
1916	392,098	81,946	43,613	21,082
1917	490,788	125,960	49,054	32,275
1918	668,398	247,701	57,032	45,435
1919	862,579	572,230	79,427	108,020

Year	Fusan		Pyengyang		Total	
	No. of Cheques	Amount Cleared	No. of Cheques	Amount Cleared	No. of Cheques	Amount Cleared
		1,000 yen		1,000 yen		1,000 yen
1910 ...	—	—	—	—	59,416	20,490
1911 ...	58,953	12,615	—	—	247,924	72,555
1912 ...	87,510	21,168	—	—	331,939	98,489
1913 ...	111,801	21,621	—	—	407,426	101,280
1914 ...	109,676	19,762	—	—	434,198	90,833
1915 ...	118,100	24,963	—	—	468,010	98,749
1916 ...	133,323	29,898	—	—	569,034	132,926
1917 ...	151,095	44,671	—	—	960,937	202,906
1918 ...	188,497	90,831	82,705	28,504	996,232	412,673
1919 ...	279,934	216,561	120,194	65,596	1,342,134	962,408

Banking Development in General.—With the establishment of the Bank of Chosen all the makeshift measures for banking purposes adopted during the transitory period were done away with, and the peninsula came to enjoy a banking system the same as that of Japan and similar to the one prevailing in the most advanced countries in the world. The currency reform also was all but completed by that time, and the Bank of Chosen notes, the legal tender, had pushed their way into the remotest corner of the country along with the subsidiary coins, which speedily replaced the old ones. The presence of a central bank to regulate and control the financial market as such, and the uniformity of coinage reducing the speculative element in banking operations to a minimum, have of themselves been a great incentive to the development of some banking enterprises. The Japanese banks with branches in Chosen now found themselves in a position to employ their ample resources with much greater freedom and safety and accordingly began to extend their operations. The agricultural and industrial banks, the working of which left much to be desired in spite of their recent foundation, were given active assistance by the newly created central bank, and greatly improved their condition, while the native banks, once on the verge of bankruptcy, regained their vitality and began to show much activity in their own small ways. Some new institutions were also established in the meantime. But the greater part taken in the banking development of Chosen in recent years was that by the central bank itself. Unlike most central banks in the world, the Bank of Chosen is not yet in a position to rest content with the mere rediscounting of bankers' bills. Banks are scarce, so operations performed in most other countries by ordinary banks are in this country performed by the central bank, consequently the development of the Bank of Chosen may be construed not only as the development of a central bank as such but also as the development of the ordinary banking business in Chosen. In the following table is given the balance sheet of all the banks in Chosen combined, including the Bank of Chosen, for the past ten years:—

COMBINED BALANCE SHEET OF ALL BANKS IN CHOSEN

Year	Capital Paid-up & Reserve Fund	Notes Issued	Agricultural Debentures	Deposits
	Yen	Yen	Yen	Yen
1910... ...	7,442,355	20,163,900	990,000	23,829,582
1911... ...	10,987,093	25,006,540	1,870,000	20,064,627
1912... ...	15,556,066	25,550,400	1,780,000	27,837,579
1913... ...	16,806,267	25,693,260	2,990,000	34,436,956
1914... ...	19,681,359	21,850,370	2,910,000	32,320,537
1915... ...	19,911,037	34,387,520	2,319,500	35,626,790
1916... ...	19,165,115	46,733,350*	1,739,000	43,716,742
1917... ...	26,189,543	68,198,369*	3,000,000	53,912,055
1918... ...	41,860,060	116,608,460*	3,000,000	84,647,493
1919... ...	66,511,500	165,299,149*	17,500,000	125,265,571

Year	Government Account	Loans and Bills Payable	Due to Other Banks, etc.	Total
	Yen	Yen	Yen	Yen
1910... ...	2,772,250	3,822,870	3,151,546	62,172,509
1911... ...	2,609,777	9,531,510	3,094,438	73,163,985
1912... ...	3,221,676	9,063,251	5,936,931	88,945,909
1913... ...	3,055,596	9,674,602	4,930,893	97,587,576
1914... ...	3,027,557	12,996,755	4,857,173	97,643,752
1915... ...	3,009,517	8,684,769	5,908,148	109,847,282
1916... ...	2,991,477	8,695,258	7,430,568	130,471,511
1917... ...	2,937,437	16,050,807	10,099,890	180,388,104
1918... ...	2,919,397	21,105,026	16,292,858	286,433,296
1919... ...	2,909,397	38,813,184	28,771,697	445,070,499

*These figures include "Fractional Notes."

Year	Cash in Hand	Money at Call, Bullion, etc.	Bills Discounted and Advances	Investments
	Yen	Yen	Yen	Yen
1910... ...	9,452,255	1,587,623	41,057,255	2,036,735
1911... ...	9,436,781	2,883,426	42,610,753	6,366,007
1912... ...	6,708,251	2,583,360	58,070,479	6,855,202
1913... ...	5,292,536	2,198,378	62,497,923	8,820,418
1914... ...	7,514,325	2,032,447	61,134,526	9,069,872
1915... ...	11,879,528	2,907,166	60,554,756	9,790,775
1916... ...	17,378,733	2,698,007	69,364,977	12,936,239
1917... ...	27,290,904	5,809,480	96,166,298	20,149,772
1918... ...	44,540,036	4,423,253	140,338,617	21,633,509
1919... ...	39,750,585	30,045,098	270,647,755	20,007,154

Year	Due from Other Banks	Bank Premises, etc.	Total
	Yen	Yen	Yen
1910	2,150,997	5,887,649	62,172,509
1911	864,838	11,002,179	73,163,985
1912	770,792	13,957,817	88,945,909
1913	957,932	17,820,386	97,587,576
1914	599,533	17,293,046	97,643,752
1915	1,132,281	23,582,773	109,847,282
1916	1,480,534	26,613,018	130,471,511
1917	1,973,412	28,998,235	180,388,104
1918	6,077,915	69,419,964	286,433,296
1919	5,727,750	78,892,153	445,070,499

Development of Commercial Bank.—In one sense, the Bank of Chosen is the largest commercial bank in Chosen, but it will be dealt with separately on account of its unique character as the central bank. Outside that bank, commercial operations are most largely carried on by the branches of Japanese banks, the most important of which are the Dai Ichi, the Hyaku-sanju and the Juhachi. The history of these branch banks goes far back into the days of the old régimé, and that of the Dai Ichi Ginko has already been given. To the credit of these banks it may be said that it was due to a large extent to their untiring efforts that anything like banking credit existed in those troubled days of old. The Dai Ichi Ginko is the most important of these, and although its one time importance as the *de facto* central bank of Chosen has long since vanished, it still occupies a place in the peninsular financial world next only to the Bank of Chosen. Three native banks, the Hansung, the Chosen Commercial and the Han-il, have also developed into small yet sound institutions indispensable to native merchants. Further, a new leaf has been turned of late in native banking history by the establishment by the Hansung Bank of a branch office in Tokyo. This event, trifling as it may seem of itself, is pregnant with significance as indicating the new spirit of enterprise now awakening in the native business community. The following list gives the names, number of branches, capital and date of establishment of the 19 commercial banks now doing business in Chosen :—

Bank	No. of Offices	Capital 1,000 yen	Date of Establishment
Dai Ichi Ginko	2	800*	May 4, 1878.
Juhachi Ginko	8	1,650*	January 1, 1880.
Hyaku Sanju Ginko	4	650*	July 20, 1882.
Mitsuyo Ginko	1	50	March 1, 1907
Sichisei Ginko	1	435	August 1, 1912.
Keijo Ginko	2	1,000	September 5, 1913.
Hansung Bank	9	3,000	February 7, 1903.
Chosen Commercial Bank ...	8	1,000	March 7, 1899.
Han-il Bank	5	500	August 8, 1906.
Ho-soh Bank	2	300	July 4, 1913.
Sanwa Ginko	1	300	November 10, 1916.
Taiku Bank	3	500	July 7, 1913.
Sennan Ginko	1	300	September 2, 1912.
Kyung-nam Bank...	3	500	September 21, 1912.
Fusan Shogyo Ginko	4	500	April 21, 1913.
Shingishu Ginko	1	500	November 24, 1917.
Tong-nai Bank	1	500	September 14, 1918.
Pooksun Commercial Bank ...	1	500	October 2, 1918.
Wonsan	1	500	February 28, 1919.
Total	58	13,485	

*These figures do not represent the full amount of capital, but that part registered as the capital of its branch offices in Chosen.

The development of these commercial banks is shown in the following table :—

Liabilities

Year	Capital Paid-up and Reserve Fund	Deposits	Government Account	Loans
	Yen	Yen	Yen	Yen
1910... ...	4,239,530	9,684,026	285,720	303,265
1911... ...	4,967,030	9,538,360	265,097	550,763
1912... ...	6,263,729	10,123,218	541,696	1,315,566
1913... ...	7,224,983	11,186,062	385,616	1,732,263
1914... ...	7,421,160	11,546,518	367,577	1,675,212
1915... ...	7,575,615	13,388,514	349,537	1,380,321
1916... ...	6,678,200	18,411,330	331,497	861,769
1917... ...	7,483,883	23,254,304	277,457	3,314,050
1918... ...	9,722,850	37,570,630	259,416	3,574,975
1919... ...	13,061,750	52,323,767	249,416	11,007,340

Year	Due to Other Banks	Other Liabilities	Total
	Yen	Yen	Yen
1910	500,240	3,231,199	18,243,980
1911	569,833	3,957,169	19,848,225
1912	651,387	3,525,134	22,420,730
1913	630,702	3,959,582	25,420,730
1914	624,477	4,918,960	26,553,904
1915	1,029,717	3,276,102	26,999,809
1916	1,137,683	3,723,314	31,143,738
1917	1,439,115	5,581,972	41,350,781
1918	2,751,305	8,631,352	62,510,530
1919	3,544,150	15,854,769	96,041,194

Year	Cash in Hand	Money at Call, etc.	Bills Discounted and Advances	Investments
	Yen	Yen	Yen	Yen
1910... ...	887,615	1,089,705	14,298,040	98,495
1911... ...	905,397	534,614	13,038,369	725,770
1912... ...	1,036,356	458,535	16,681,135	1,414,552
1913... ...	1,144,867	267,305	18,545,058	1,470,627
1914... ...	761,582	450,648	17,830,979	1,482,962
1915... ...	860,200	681,913	18,881,554	1,995,342
1916... ...	1.270,523	774,939	21,048,121	2,278,615
1917... ...	2,330,642	963,448	29,093,394	3,306,886
1918... ...	4,016,570	1,355,876	44,968,721	3,541,058
1919... ...	4,816,102	1,838,075	78,385,229	2,682,707

Year	Due from Other Banks	Bank Premises, etc.	Total
	Yen	Yen	Yen
1910	524,774	1,345,351	18,243,980
1911	3,033,904	1,610,171	19,848,225
1912	363,116	2,567,036	22,420,730
1913	352,900	3,338,469	25,119,226
1914	207,213	5,820,519	26,553,903
1915	399,898	4,182,897	27,001,804
1916	515,035	5,256,560	31,143,793
1917	724,955	4,931,456	41,350,781
1918	996,648	7,631,655	62,510,531
1919	1,452,787	6,866,292	96,041,194

Development of Agricultural and Industrial Banks.- These banks, which played so important a figure in the banking history of Chosen, have ceased to exist since September 30, 1918, when they were amalgamated into one large institution, the Chosen Industrial Bank. This amalgamation, however, does not signify that the older institutions failed in their object, or in their business, nor does it signify that their services were no longer needed. It is true that they had many shortcomings, and that these became more and more evident as they drew nearer to the end of their existence, but on the whole their career was one of development and useful service. At the time of annexation there were in Chosen six agricultural and industrial banks, their number which was once nine having been reduced to six by amalgamation, and these with their numerous branches, 41 on September 1, 1918, covered fairly well the whole peninsula. In almost every place, of commercial or agricultural importance, one of their branches could be found, and, inadequate as they were in the means at their disposal and in their equipment, proved indispensable credit-givers in their respective localities. Excellent service was also rendered by them in the form of assistance given to the central bank in the prosecution of its financial programs, the notable case being the withdrawal of the old debased coins and the dissemination of the new ones. On the other hand, the Bank of Chosen was not slow in helping them out of the difficulties into which some of them fell on more than one occasion. Through their very nature they displayed a constant tendency to lock up their funds, which, by the way, consisted of capital, proceeds of debentures, and government loans, in land and other immovables, and this made the timely assistance by the Bank of Chosen all the more necessary. It was once observed that they acquitted themselves rather poorly of their first duty, that of supplying agricultural funds, but then they had to deal with one of the most difficult banking problems in any country, viz., agricultural credit. They were certainly no less successful than most of the institutions of the same kind in Japan. In the following table are given their names, capital, and so forth as they were in September, 1918, just before the amalgamation :—

Banks	Capital Subscribed 1,000 Yen	Capital Paid-up 1,000 Yen	Reserve Fund 1,060 Yen	Deposits 1,000 Yen	Loans 1,000 Yen	Debentures 1,000 Yen	Government Account 1,000 Yen
Kanko Noko Ginko...	1,000	550	148	2,879	4,906	1,000	462
Keisho Noko Ginko...	600	300	167	2,765	4,006	600	290
Heian Noko Ginko...	200	200	18	2,432	3,789	500	396
Jenshu Noko Ginko...	300	150	104	1,451	2,061	430	60
Koshu Noko Ginko...	300	150	73	1,421	1,772	370	90
Kankyo Noko Ginko	200	119	95	2,180	2,218	100	160
Total	2,600	1,469	606	13,130	18,755	3,000	1,459

Their development may be gathered from the following table:

Year		Capital Subscribed 1,000 Yen	Capital Paid-up 1,000 Yen	Reserve Fund 1,000 Yen	Deposits 1,000 Yen	Loans 1,000 Yen	Debentures 1,000 Yen	Government Account 1,000 Yen
1906...	...	1,100	508	7	163	919	450	818
1907...	...	1,200	588	37	511	2,203	450	1,003
1908...	...	,,	555	108	752	2,681	1,050	1,094
1909...	...	,,	,,	114	2,182	4,124	1,050	1,134
1910...	...	,,	,,	144	3,223	6,344	990	,,
1911...	...	,,	818	185	4,140	8,509	1,780	,,
1912...	...	2,400	1,348	386	4,469	10,456	1,780	1,479
1913...	...	2,600	1,467	479	4,599	11,583	2,990	1,469
1914...	...	,,	1,469	486	4,718	11,554	2,910	1,459
1915...	...	,,	,,	487	6,456	11,462	2,319	,,
1916...	...	,,	,,	440	8,017	12,713	1,739	,,
1917...	...	,,	,,	552	9,734	17,664	3,000	,,

Development of Credit Associations.—The local credit association in Chosen is perhaps one of the smallest institutions of the kind, at least when taken individually. In its earlier days the funds at the disposal of each association were confined to Y. 10,000 contributed by the government, and though in later days this sum was augmented by subscription to its shares by members and by members' deposits, the amount disposable was never anything considerable. But it may be said that the very efficiency of the association rested in its smallness, which matched well the condition of the Korean peasants in days gone by. A change, however, became needful as time progressed and the economic power of the peasantry increased, so the association regulations, originally enacted in 1907 and revised in 1914, were revised for the second time in 1918, and, as the result, not only has the scope of their operations been largely extended, but it has also been made possible to create under the same regulations town-associations administering to the needs of petty traders and merchants. The main points of the changes introduced by the new regulations may be summarized as follows :

The amount of a share hitherto fixed at Y. 10 was extended to a sum not less than Y. 10 and not more than Y. 50 ; the principle of election was recognized in the appointment of its officials, exceptions being made of certain associations for which Japanese managers appointed by the government are required as hiherto ; the association was authorized to issue warehouse-warrants on the goods deposited with it by its members ; it may act as an agent for any bank ; and last, but not least, associations in urban districts were authorized to engage in bill discounting.

In a word, the associations are being turned into so many small banks to serve the poorer people of every class. These institutions are scattered all over the peninsula, 391 in all, and can be approached by any farmer desirous of obtaining funds on reasonable grounds. Their development in the past is shown in the following table :—

Liabilities

Fiscal Year		Capital 1,000 Yen	Foundation Fund 1,000 Yen	Reserve Fund and Balance from Previous year 1,000 Yen	Loans 1,000 Yen	Deposits 1,000 Yen	Other Liabilities 1,000 Yen	Total 1,000 Yen
1910...	...	—	1,170	59	279	—	170	1,679
1911...	...	—	1,530	159	345	—	132	2,166
1912...	...	—	1,890	275	406	—	142	2,714
1913...	...	—	2,080	396	441	—	541	3,459
1914...	...	71	2,334	491	465	108	474	3,944
1915...	...	177	2,467	530	476	294	360	4,307
1916...	...	309	2,570	583	470	458	655	5,047
1917...	...	494	2,679	682	547	736	1,292	6,433
1918...	...	709	2,682	812	959	1,405	2,527	9,096
1919...	...	1,627	2,884	899	10,445	5,502	6,065	27,424

Assets

Fiscal Year		Advances 1,000 Yen	Premises, etc. 1,000 Yen	Money at Call 1,000 Yen	Other Assets 1,000 Yen	Cash on Hand 1,000 Yen	Total 1,000 Yen
1910	...	762	61	497	59	298	1,679
1911	...	1,182	98	566	53	265	2,166
1912	...	1,725	150	636	8	194	2,714
1913	...	2,158	266	435	417	180	3,459
1914	...	2,147	361	728	552	154	3,944
1915	...	2,127	411	1,251	385	131	4,307
1916	...	2,818	428	1,121	553	124	5,047
1917	...	3,761	512	889	1,131	138	6,433
1913	...	5,144	535	736	2,499	180	9,096
1919	...	18,329	673	1,780	6,011	628	27,424

The Closing of the Agricultural and Industrial Banks and the Establishment of the Chosen Industrial Bank.—We have already pointed out that the Agricultural and Industrial Banks, though excellent institutions in themselves, had many shortcomings, and these became more and more evident as they drew nearer to their closing days. The fact is that the times had changed and old institutions had to be made conformable with the altered state of things sooner or later, and, in this case, the alteration was made by closing the older institutions and establishing a new one. One of the principal shortcomings of the Agricultural and Industrial banks was the lack of unity and co-operation between them. With different business districts, boards of directors, and wide disparity in capital and other resources, and varying in degree of soundness or unsoundness, each was wont to go its own way, making it extremely difficult, if not impossible, to secure the much needed co-operation and mutual assistance which, if secured, would have benefited all. In many cases funds were found lying idle in one bank while another was hard pressed for them. Another of their shortcomings was the inadequacy of capital. At the time of amalgamation the capital of the six banks amounted in the aggregate to only Y. 2,600,000, and that of the smallest one to Y. 200,000 only, and although they were granted government loans their funds proved far from sufficient. In short, not one of them could have been anything but a weak institution had it not been backed by the government, whereas, combined together with capital sufficiently enlarged, they were capable of being formed into a strong institution standing on its own feet, and firm enough to inspire confidence on its own merit. To remove these defects, several views were advanced, some of which favoured the establishment of a hypothec bank, such as the one in Japan, to act as the central bank, leaving the agricultural and industrial banks essentially as they were. Somehow, these opinions were dropped, but a law was issued in June, 1918, authorizing the establishment of the Chosen Industrial Bank with a capital of Y. 10,000,000, into which all the agricultural and industrial banks then in existence were to be absorbed. The shareholders of the old institutions were given share for share in the new institution, and the balance was placed on the market for public subscription. On the 1st of October, 1918, the Chosen Industrial Bank came into being, at the same time the older institutions were closed and their business transferred to the new bank. As far as appearance goes this produced but little change, since all the offices of the Agricultural and Industrial Banks, both head and branch offices, were converted into branches of the new bank, with the exception of the one in Seoul which was made the head office. But, in the internal management a complete change was made. Mr. T. Mishima, senior director of the Bank of Chosen, was appointed president of the bank while still remaining director of the Bank of Chosen. One of the directors was further chosen from the staff of the same bank, while not one director was supplied by the former institutions, although a great majority of the staff remained officials of the new bank. Thus the Chosen Industrial Bank entered upon its career in the 1st of October, 1918, quite new in most respects, yet with 46 branches, a built-up business, and a body of well-trained men. The business of the bank was, as is natural, the same in the main as that of the old agricultural and industrial banks, but some new additions were made in order to meet the fresh requirements called forth by the recent agricultural and industrial development. The following is a brief summary of its business :—(1) to make loans on the security of immovable property or the rights to immovable property, redeemable in annual instalments within a period of thirty years, or in one sum within a period of five years ; (2) to make loans on the security of fishing rights, redeemable in one sum within a period of five years ; (3) to make loans of the description of (1) on the security of foundations organized by law ; (4) to make loans without security on the joint signatures of 20 or more farmers or industrials, redeemable in one sum within a period of five years ; (5) to make loans of the description of (1) without security to public bodies ; (6) to make loans of the description of (1) without security to credit associations, fishery associations, and similar other legal persons, the object of which is not money making ; (7) to make loans on the security of the native products of Chosen or the goods necessary for native industry ; (8) to make loans on national loan bonds or other bonds approved by the government-general of Chosen ; (9) to deal in bills of exchange with or without documents ; (10) to subscribe to or underwrite debentures of public bodies or of companies whose object is to engage in industrial works in Chosen ; (11) to engage in trust business ; (12) to receive deposits of money, or of gold and silver buillion, and documents of value for safe keeping, etc.

The bank is authorized to issue debentures to the extent of ten times the amount of its paid-up capital, and also to engage in the business of a commercial bank for the time being.

It is yet too soon to dwell upon the doings of this new institution, but the following statement will show something of the activity it has already launched upon :—

CHOSEN INDUSTRIAL BANK
Balance Sheet, December 31, 1919

Liabilities	Yen
Capital and reserve fund	8,684,750.00
Agricultural deventures	17,500,000.00
Deposits	34,883,443.72
Government account	1,459,980.60
Loans	11,297,402.46
Due to other banks	2,961,267.06
Other liabilities	2,115,261.43
Total	78,902,105.27
Assets	Yen
Cash in hand	5,068,685.55
Agricultural advances	29,371,697.42
Other advances	41,684,022.13
Investments	562,384.25
Due from other banks	616,249.02
Bank premises, etc.	1,599,066.90
Total	78,902,105.27

Banking in Manchuria

By T. HOSHINO

THE origin of banking in China is enshrouded in mystery. But it is recorded that in the reign of Emperor Hsien Tsung of the Tung Dynasty (806-821 A.D.), there prevailed in China a method called *feichien* (flying money) by which one could pay in money at a government office in the capital and receive in exchange therefor a bill which he might present at a local government office for encashment. This was apparently the origin of bills of exchange in China. Much the same method obtained in Korea under the name of *wei-hwek*, in which the indebtedness of a local office to the central and *vice-versa* were availed of as a means of remittance.

There are at present three types of native banking in China represented by the *piaochuang*, *chienchuang* and *yinlu*, and it is interesting to note that these three types had three different origins and developed along lines greatly differing from one another.

About 280 years ago there was established in the province of Shanhsi a private institution with a view to engaging in the remittance of money from one place to another. It being successful, many similar institutions came into being, and all these were called by the general name of Shanhsi Piaochuang. The business of these institutions was first confined to the remittance of money, but it was extended, as time went by, to other lines of business, until it came to include nearly all the branches of what we now call banking. They established branches and correspondents at nearly all the important points of the Chinese empire, including Manchuria, and the influence exercised by them was at one time so great that it seemed to monopolize the financial business of that great empire. Such was the origin of the once famous Shanhsi Piaochuang.

Again, the disorderly state of currency existing in China for many centuries past called into being a horde of money-changers, whose business was to exchange one local coin for another and get profit out of the exchange. The progress of the inter-provincial trade in the sequel of the opening of Shanghai made the demand on this business so much the greater, and in consequence those engaged in the business grew in number as well as in wealth. These also began to receive deposits, make advances, issue bills of exchange, and generally carry on banking business. Thus were originated what now go by the name of *chienchuang* or *chienpu*.

Then there were silversmiths called *yinlu* engaged in the making of sycee, and these also developed their business into banks, in so far as they received deposits from customers, and effected monetary settlements between such customers by mere book transfers, thus eliminating the use of actual money. This gave birth to that famous system of the "transfer tael" in Newchwang.

Thus the *piaochuang*, *chienchuang* or *chienpu* and *yinlu*, which represent the three principal types of native banking in Manchuria as well as elsewhere in China, sprang from three distinct origins, and it is interesting to note that, though their functions are now largely intermingled, each still retains some of its old traits.

The practice of raising money by pawning goods has also been in evidence in China from time immemorial, and, as far back as the period of Tung, we see restrictions placed on the amount of interest and regulations as to the manner in which interest is added to the principal.

All these bank-like organs exist to-day, though both *piaochuang* and *yinlu* have now practically disappeared from Manchuria except in Antung where, strange to say, both these institutions still exist, though what they now enjoy is but the shadow of their former prosperity. We will not go, therefore, into details of these institutions, but go straight on to a description of the *chienpu*, which, though shorn of much of its former importance, still plays an active rôle in the Manchurian money market.

The *chienpu*, also called *chienchuang* or *yinhao*, is generally of partnership organization with a capital ranging from *Yuan* 50,000 to 200,000. They exist in almost every town, and the small ones, faithful to their tradition, still make money-changing their principal business. But the larger ones receive deposits, make advances, issue bills of exchange, and also the notes which we described as *tiehtzu* in the previous chapter, and further engage in the sale and purchase of moneys. Take a *chienpu* in Changchun, where they prosper most, and examine its working a little. The deposits are divided into the current and fixed. On current accounts no interest is paid, but on fixed deposits interest is paid at the rate of something like 5 per mille monthly, making 6 per cent. per annum. Though no interest is paid on current deposits the accounts amount to a considerable sum with some *chienpu* and are made the source of many profitable operations. The payment made through the *chienpu* is called *chenma*, and is effected by the depositors informing his *chienpu* of the amount to be paid and the name of the beneficiary. Advances are made on personal credit, with or without the guarantee of a surety and rarely on collateral securities. The term is three months at the longest, ordinarily one month. The rate of interest is, of course, subject to the market rate, but generally 1 per cent. per month. To reliable customers, the *chienpu* is always ready to allow an overdraft to a certain extent, changing them more or less high interest. Since advances are as a rule based upon personal credit, they keep more than ordinary vigilance over the financial condition of their customers. They are rather inclined to refuse advances altogether than to demand collateral securities. The exchange operations of the *chienpu* are confined to the local remittance of money, and are generally on a very small scale. Those on larger scale were formerly conducted by the *piaochuang* and at present by the banks of modern type.

Pawn-Shops.--Pawn-shops are found in almost every place in Manchuria. The largest is called *tang*, the next in size *chihtien*, and the smallest *ya*. These constitute practically the sole monetary organs accessible to farmers, petty merchants and the lower classes of the people generally. The large pawn-shops, called *tang*, are often affiliated to the banks of modern type, and are established sometimes by men of high official position, with a capital upward of *Yuan* 50,000. Thus the Kung Chi Tang, a large pawnshop with offices at Mukden, Newchwang, Antung and Chengchiatun, is a subsidiary organ to the Three Eastern Provincial Bank, while the Kirin Government Bank has also a pawn-shop attached to it. Also in Newchwang there is a pawn-shop called San Hui Tang largely financed by provincial officials of position.

The rate of interest charged by the pawn-shops ranges from 2 to 3 per cent a month, while the term is often prolonged to one or two years. The articles pawned consist chiefly of clothing, followed by jewelery. In small pawn-shops called *ya* the interest is much higher, being 4 to 8 per cent. a month, and the term rarely exceeds four months. The private notes called *tiehtzu* are largely issued by pawn-shops, and there are places, such as Chinchou, where the note-issue is practically limited to them. The private notes, issued by the San Hui Tang above referred to, enjoy a credit unsurpassed by any native bank-note.

Native Banking of Modern Type.--Modern banking in Manchuria, so far as our knowledge goes, dates from 1897, when the Russo-Chinese Bank established its branch office in Newchwang. In all probability the English had a monetary organ to serve their interests, presumably an agency of the Hongkong & Shanghai Banking Corporation, but we have at hand no data to prove the fact. The Yokohama Specie Bank opened its branch in Newchwang in 1900. The establishment of modern banks by the natives belongs to the period following the Russo-Japanese war, and the Mukden Government Bank (now Three Eastern Provincial Bank) which was founded in 1905 may be regarded as the first institution of the type ever established in Manchuria. An institution, which afterwards became the provincial bank of Kirin, was established at Kirin as early as 1898, but it is doubtful if it could properly be called a bank of modern type at the time of its establishment, its very capital then being unknown to a certainty.

At the end of May, 1919, there were altogether 22 native banks of the modern type in Manchuria, 10 of which had their head offices in South Manchuria, and 12 in North Manchuria. Besides, there were four banks having head offices in China proper. These 26 banks, with their branches and agencies, cover well-nigh all the important points of Manchuria, and outwardly Manchuria is by no means destitute of modern banking facilities administered by the natives. But a closer observation will reveal the fact that these institutions, modern to all appearance, are, with a few exceptions, not modern in their practice. They publish no statements, so that the public is left in the dark as to their financial standing. Nearly all of these institutions are vested with the power of note-issue, which however has been abused to the last extreme. Speaking generally, most of these institutions are financially weak, and have no such credit as banking institutions in other countries generally have in their respective communities. But it would be too much to say that they are useless or even harmful in all cases. Poorly backed as they are by specie, with payment often suspended, their notes still circulate, though always at a discount, and are nevertheless indispensable for the trade and commerce of the country. Nor is their superiority to the banks of the old style to be doubted for a moment, for since their appearance all the business hitherto conducted by the old-style bank is gradually passing into their hands. The root of the evils, it appears, is in the chaotic state of currency, and in the lack of strong central authorities to enforce the laws and regulations which are, as we have seen, in the main excellent.

The difference in nature of these native institutions may be inferred to some extent from their names. The provincial government banks are endowed more or less with the nature of a central bank, the Mukden Industrial Bank and the Territorial Bank, with the nature of an industrial bank, and the Bank of Communication with that of an exchange bank. But these differences are more nominal than real. Owing to the fact that, as noted above, no statement whatever is published by these banks, it is difficult to gauge their condition. One of the Japanese periodicals in Manchuria, the *Mammo-jitsugyo-iho*, has published a table showing the financial status of the native banks in Mukden, as they stood at the end of June, 1918. In the absence of any other information, this is given below in all its incompleteness.

Banks	Deposits			Advances		
	Government	Public	Total	Government	Public	Total
	1,000 *Yuan*	1,000 *Yuan*	1,000 *Yuan*	1,000 *Yuan*	1,000 *Yuan*	1,000 *Yuan*
Three Eastern Provincial Bank	1,395	1,205	2,600	500	4,085	4,585
Mukden Industrial Bank ...	?	?	?	1,000	2,000	3,000
Mukden Branch of the Bank of China	1,000	230	1,230	150	500	650
Mukden Branch of Communication Bank ...	400	300	700	200	400	600
Mukden Branch of the Territorial Bank	?	?	?	100	2,000	2,100
Mukden Branch of the Amur Govern't. Bank ...	?	?	?	50	50	100
Mukden Commercial Bank	?	500	500	?	1,441	1,441
Total	2,795	2,235	5,030	2,000	10,476	12,476

A glance at the above table, which, if not correct in details, may at least be taken as indicative of some of the principal features of these banks, will at once show that the deposits are exceedingly small as compared with the advances. This is due to some extent to the conservativeness of the people, but the small credit enjoyed by the banks must largely account for it. Many of the people think it safer to keep their money in their strong box, or to place it in the care of some big merchants or rather of the *Chienpu*. The result is that these banks must seek other resource for their loanable funds. Nor can they depend upon their capital, which is generally very small, and the difficulty of increasing it is easily imagined from the fact that, with the credit of the Bank of China, it was no easy matter for the authorities to find subscribers to its new shares. The two main sources of funds being thus but slightly available, the only course open to them is the note-issue, and with what freedom this course was resorted to by the native banks has been pointed out. Under these circumstances, the growth of the deposit banks, which in other countries are the bones and sinews of their financial structure, is hardly possible in Manchuria.

The abhorrence with which the commercial public regard the contract of loans on collateral securities is another obstacle in the way of the healthy development of banking. Most advances are made on personal credit, or at best on the guarantee of friends of the borrowers. It is clear that no sound banking can exist so long as this custom obtains.

Interest charged by such large banks as the Three Eastern Provincial Bank, the Bank of China, or the Bank of Communication is said at this moment to range between 12 to 16 per mille monthly (14 to 19 per cent. per annum), that by the Territorial Bank from 14 to 20 per mille and that by the Mukden Commercial or

Huafu Industrial Bank from 14 to 22 per mille. In addition to this, the borrower has to pay extra as commission to the bank's officials—another objectionable feature in native banking—and also to his surety. Thus it will be seen that money costs pretty dear in Manchuria, but there is no wonder in this, when the risk of depending purely on personal credit, by no means always very solid, is taken into consideration.

Deposits are received on current account or for a fixed term. The rate paid on them is said to be 9 per cent. for a fixed deposit, and about 3½ per cent. for current deposit, but actually seems to be considerably lower. They certainly could not afford to pay much on their deposits when they have a more profitable source of funds in issuing notes, for which no adequate reserve is usually kept.

Japanese Banks.—Japanese banking in Manchuria dates from 1900 when in January of that year the Yokohama Specie Bank opened a branch office at Newchwang. The following few years saw the bank make a rapid progress, thanks to the constant growth of Japan's trade with Manchuria, to which the bank in its turn made an important contribution. In January, 1903, it issued its first notes in Manchuria. On the outbreak of the Russo-Japanese war, the bank was compelled to close its Newchwang branch, but when the port was occupied by the Japanese the following year, not only was the branch re-opened, but new offices were established at Dairen, Liaoyang, Mukden and Tiehling, as these places were occupied one after the other by the Japanese troops, and these were made the so-called cash offices of the Manchurian armies of Japan. After the war the bank was entrusted by the Japanese government with the task of withdrawing its military notes diffused during the war, and also of generally assisting in the promotion of the trade between that country and Manchuria. More branches were subsequently established in Changchun, Harbin and Kaiyuan, and with its general office, first at Newchwang and then at Dairen, the bank came to enjoy much the same position as the one once enjoyed by the Dai Ichi Ginko in Korea. It is indeed a strange coincidence that both these banks were destined at a later period to transfer much of the business in their respective fields to the one and the same bank, the Bank of Chosen.

But the Yokohama Specie Bank, whose leading business was in the line of exchange, fell in many instances short of the demand made on it by the Japanese public in Manchuria, who required long term loans in order to finance their enterprises, and these the bank could not afford to grant from its very nature. But the drawbacks were remedied to some extent through the government measure, by which the Bank of Japan was called upon to make to the bank a low interest loan of Y. 3,000,000, later increased to 5,000,000, to be used for these specific purposes.

In 1906 a Chino-Japanese Joint Stock Bank called Shoryu Ginko was established with a capital of 300,000 silver yen at Newchwang with a branch at Dairen. The result of its business in its initial stage was anything but satisfactory. It was in consequence completely reorganized in 1911, its capital being increased to 700,000 gold yen and 300,000 silver yen all paid up, while its head office was removed to Dairen. After that the progress of the bank was phenomenal. It is now the largest bank having its head office in Manchuria and managed by Japanese. To cope with the expansion of its business the bank's capital was increased to Y. 3,000,000 in 1905.

Subsequent to the establishment of the Shoryu Bank a large number of Japanese and semi-Japanese banks were established. But the most significant event in the financial history of Manchuria of recent days is the appearance of the Bank of Chosen in Manchuria. Of the progress of this important institution, details will be given later on, but to summarize its career, this peninsular Bank has had a branch in Antung ever since its establishment, transferred to it by its predecessor, the Dai Ichi Ginko, but for various reasons the bank remained inert so far as its Manchurian business was concerned. Meanwhile the bridge over the Yalu was completed, the reduction by one-third of the regular tariff on land trade came into force, and all this resulted in a great development of trade between that peninsula and Manchuria. Moreover, such was the trade condition of the peninsula at that time that, unless the bank extended its sphere of business to adjacent countries, it was difficult for it ro maintain its specie reserve. Prompted by these various reasons the Bank of Chosen appeared in the Manchurian financial field, and, without being aggressive, so great was the demand made on it that its business was soon found expanding in all directions, outstripping many older institutions, not excepting even the Yokohama Specie Bank. There is little wonder in this, however, for the Bank of Chosen partaking of the character of a colonial bank is decidedly the better fitted of the two, for the services required in Manchuria.

Finally, in December, 1917, the various privileges hitherto enjoyed by the Yokohama Specie Bank were made over to the bank, making the latter the central bank of Japanese Manchuria.

Another Korean institution entered Manchuria in 1917. That was the Oriental Development Company. Originally established to engage in Chosen in the colonization and exploitation of the country, the company was later enabled by a revision of its laws to extend its work outside the peninsula. It established branches in Mukden and Dairen in October, 1917, took over the business relative to the industrial funds elsewhere explained from the Yokohama Specie Bank, and made itself the chief supplier of industrial credit in Manchuria. The chief feature of the banking department of this company is in the great variety of the securities upon which loans are made, including mining rights, lands, houses, factories, forests, railroads, etc., either direct or through other institutions. Its activity in Manchuria is best shown by the fact that during the period of about one year ending February, 1919, the total amount invested by it aggregated no less than Y. 11,300,000. The company has further acquired interest in some 18 companies, mostly through subscription to their shares. The Tosho Jitsugyo Kaisha, capital Y. 3,000,000, is a company of its creation, and closely affiliated to it in business. The principal business of this company consists in loans on products, estates, etc.; buying and selling of products on its own account or on account of third parties; trust and guarantee business; subscription to shares and debentures, etc.

JAPANESE BANKS IN MANCHURIA

(Conditions as on May 31, 1919)

Name of Bank	Date of Establishment	Authorized Capital Yen	Paid up Capital Yen	Location of Head Office	No. of Branch Offices in Manchuria
Bank of Chosen	...Oct. 1909	40,000,000	30,000,000	Seoul	18
Yokohama Specie Bank	Feb. 1880	48,000,000	42,000,000	Yokohama	6
Dairen Commercial Bank ...	...Nov. 1918	2,000,000	500,000	Dairen	—
Dairen Bank	...Dec. 1912	1,000,000	575,000	Dairen	1
Sung Hua Bank	...May 1914	1,000,000	362,500	Harbin	—
Educational Savings Bank ...	...Sept. 1900	500,000	200,000	Tokyo	1
Changchun Bank	...Jan. 1918	350,000	175,000	Chngchun	2
Trade Bank ...	...Aug. 1913	200,000	50,000	Tiehling	—
Changchun Business Bank ...	...Jan. 1918	200,000	100,000	Changchun	—
Wafangtien Bank	...Feb. 1918	100,000	50,000	Wafangtien	—
Szupingchieh Bank	...Feb 1918	70,000	17,500	Szupingchieh	—
Tiehling Bank	...Mar. 1908	50,000	31,250	Tiehling	—
Commercial & Industrial Bank ...	...Apr. 1913	50,000	25,000	Liaoyang	1

CHINO-JAPANESE BANKS IN MANCHURIA.

(Conditions as on May 31, 1919)

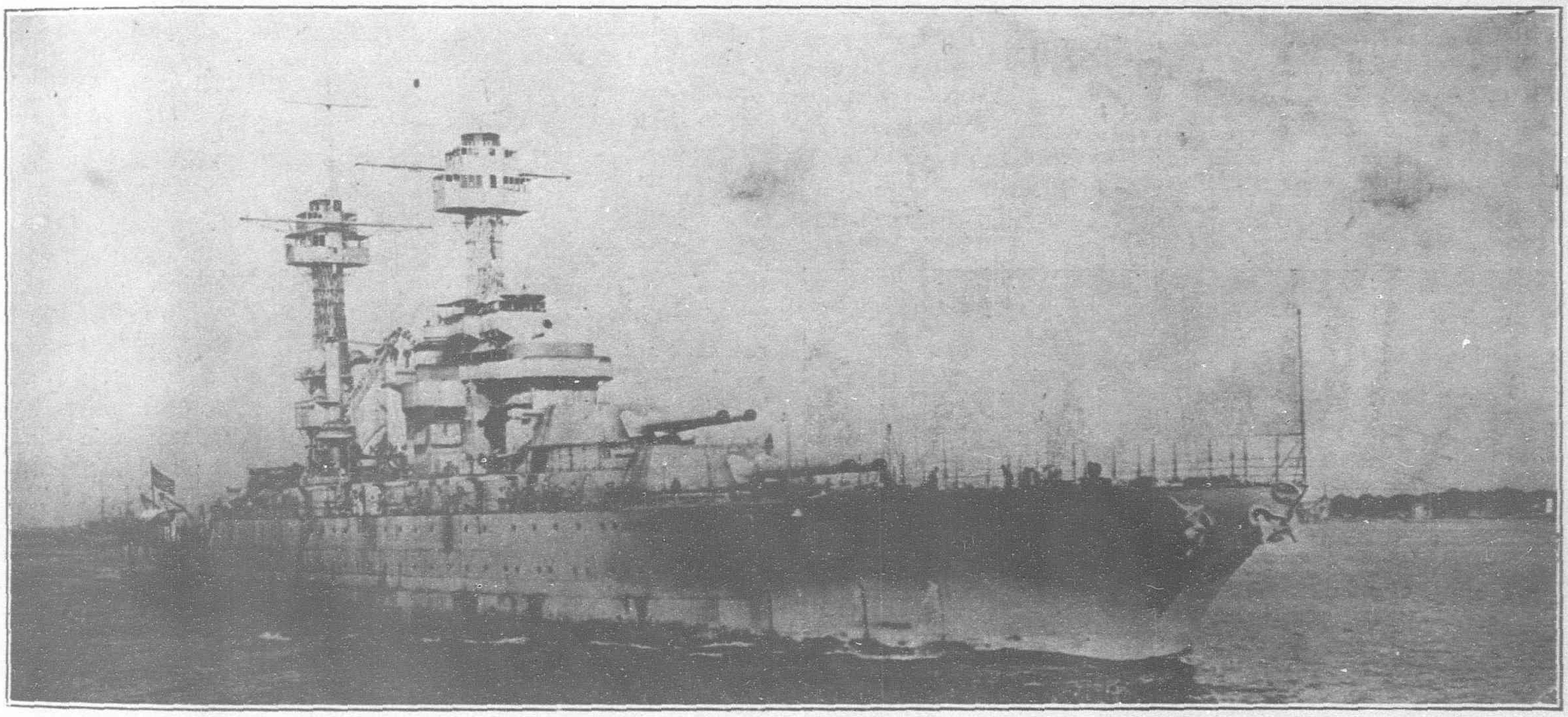
Name of Bank	Date of Establishment	Authorized Capital Yen	Paid up Capital Yen	Location of Head Office	No. of Branch Offices in Manchuria
Syoryu Bank ...	...July 1906	3,000,000	3,000,000	Dairen	9
Manchurian Commercial Bank ...	...May 1911	1,400,000	425,000	Antung	2
Lungkow Bank	...May 1913	1,000,000	750,000	Dairen	—
Liaoyang Bank	...June 1916	1,000,000	295,000	Dairen	5
Mukden Bank ...	...Dec. 1918	1,000,000	250,000	Mukden	—
Antung Bank ...	...May 1911	500,000	300,000	Antung	4
Tiehling Chino-Japanese Bank ...	...May 1918	300,000	75,000	Tiehling	—
Port Arthur Bank	...May 1918	150,000	37,500	Port Arthur	—
Pitzuwo Bank ...	...Jan. 1917	100,000	50,000	Pitzuwo	—
Fanchiatun Bank	...Oct. 1917	100,000	50,000	Fanchiatun	—

(*Continued on page 260*)

Electricity and the American Navy

THE superdreadnought, the U.S.S. *Maryland,* is in every respect the latest completed achievement of American naval architects. Carrying eight 16-inch guns, the largest ever mounted in a battleship, she will be the most powerful fighting vessel in the world. These mammoth guns, located in four turrets of two guns each, fire a shell weighing 2,100 pounds for a distance of more than 20 miles. These guns are about 57-ft. in length and for each full charge approximately 480 pounds of powder are required.

The secondary battery, consisting of fourteen 5-inch guns, is carried for use against torpedo-boats, submarines and other smaller craft. The ship has also four 3-inch anti-aircraft guns, a 3-inch landing gun, six ·30 caliber machine guns and two under-water 21-inch torpedo tubes for firing the largest and longest range torpedoes.



The U. S. S. "Maryland," 32,600 Tons, the latest American Fighting Ship. Electrically driven

The *Maryland* possesses all the latest provisions for protection against torpedo attacks. It is claimed by naval architects that it will be almost an impossibility to sink the ship by an under-water attack. The crew and vital parts will be protected by armor plate so thick that only the largest caliber shells, fired at moderate range, might penetrate.

Displacing 32,600 tons, this huge warship, electrically driven, will have a speed of 21 knots and a cruising radius of 10,000 miles. She will burn oil, her fuel capacity being approximately 1,392,200 gallons.

The *Maryland* is 624-ft. long and has a beam of $97\frac{1}{2}$-ft. There will be 67 officers in the ship's completement and more than 1,400 men in her regular crew.

This most modern of warcraft recently completed her builders trials with a perfect record. For 33 continuous hours at sea off the Virginia Capes, she was put through all sorts of tests, bringing into play the greatest possible stress on all parts of her machinery and equipment but not the slightest trouble was experienced. In fact naval officials declared she operated more like a boat that had been in service four or five years, so readily and easily did she respond in the tests.

Captain Charles F. Preston, who has been assigned to the command of the *Maryland* and was aboard during the preliminary trials, is most enthusiastic over the perfect performance of the new electric ship. "Never on a warship that pleased me more in my 36 years with the navy. She's a wonder in every respect, the best warship in our navy and the most powerful in the world" he declared, "I am highly pleased and satisfied with her electric equipment. There is practically no vibration and sometimes I actually looked out to sea to learn if we were under power so quietly and smoothly did her machinery operate."

Like her prototype, the *New Mexico,* pioneer electric warship of the world, the *Maryland* is electrical throughout. Her main propulsion machinery consists of two Curtis steam turbine generators, each designed to develop 11,000 kilowatts at a speed of 2,030 revolutions per minute to drive the ship 21 knots. These supply power to four 7,000 horse-power General Electric induction motors, directly connected with the four propellers and turning at 170 revolutions per minute. The motors, among the largest ever built, are 12-ft. in diameter, weigh 62 tons, and the 28,000 horse-power thus available for propulsion purposes is enough to supply power to a city of 100,000 population.

The two turbine generators, supplied with steam generated by eight oil-burning boilers, can be run independently. Either is capable of driving the ship up to a speed of about 17 knots. The power generated by them is used for no other purpose than propelling, electrical current for other needs being generated by six 300-kilowatt turbine generators.

Virtually every electrical appliance used afloat and ashore has been installed in this new battleship. The electrical equipment includes radio telegraph, loud-speaking telephones, ordinary telephones, gyroscope compass, steering gear, anchor windlass, capstan, boat cranes, winches, air compressors, air heaters, turret training, turret gun elevating, ammunition hoists, gun firing, range signalling, powder testing oven, common deck fans, ice machines, laundry equipment, carpenter shop, lighting, visual signals, motion pictures, sterilizer in operating room, potato peeler, ice-cream freezer and other kitchen utensils, bake ovens, irons for laundry and tailor, storage batteries, motor-boat ignition, etc.

It is probable that no ship built by any nation in the past has been so thoroughly equipped for the comfort and convenience of the crew.

A completely equipped hospital will be maintained on board with navy surgeons to look after the health of the crew and a dentist to look after the men's teeth. A chaplain will be assigned to the ship to hold regular church services and to devote his time to spiritual welfare of the officers and men.

The *Maryland* is third in order of completion of the electrically propelled battleships for the navy. She was built by the Newport News Shipbuilding & Dry Dock Company and the electrical equipment was designed and manufactured by the General Electric Company.

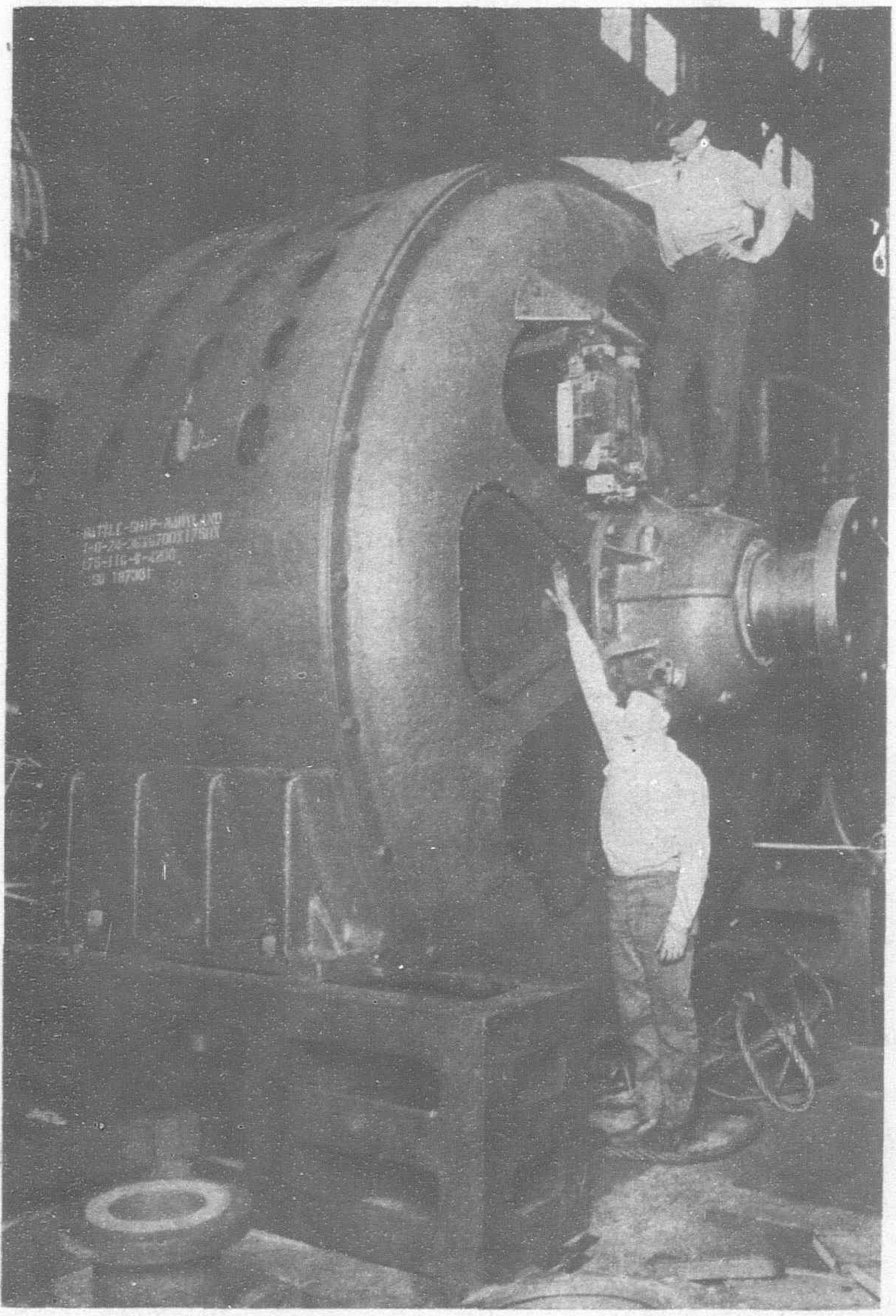
The ship was launched on March 20, 1920. Her chief characteristics are:

Length	624 feet
Beam	97 1/2 feet
Draft	30½ feet
Weight	32,000 tons
Speed	21 knots
Number of propellers	4
Shaft horse-power..	30,000
Oil capacity	1,400,000 gallons
Oil-burning boilers..	8

Four more battleships of this type are being built, the *California* to be completed this summer; the *West Virginia* to be ready for her trial trips in 1922, the *Colorado* and the *Washington*. In addition the navy is building six 43,000-ton, 60,000 horse-power battleships and six battle cruisers, rated at 180,000horse-power each or six times as powerful as the *Maryland*. Both of these type of warships will carry 16-inch guns and will be electrically driven.

Capt. Charles F. Preston of the U. S. S. "Maryland"

Production of the electrical machinery for several of these vessels is now progressing under the direction of W. L. R. Emmet, consulting engineer of the General Electric Company, who advocated the principles of the electric drive as long ago as 1909, was instrumental in its adoption by the government, and designed the first electric drive installed by the navy on a battleship, now working so successfully on the U.S.S. *New Mexico.*



One of the Propeller Motors of the U. S. S. "Maryland"

Banking in Manchuria

(*Continued from page 258*)

Foreign Banks.—Three are three foreign banks doing business in Manchuria, viz., the Russo-Asiatic Bank, the Hongkong and Shanghai Banking Corporation, and the Chartered Bank of China, India and Australia. The Russo-Asiatic Bank was the first of the foreign banking institutions to establish a branch in Manchuria, its Newchwang office having opened to business in 1897. It now retains but a shadow of its former prosperity, yet it still has branches at Newchwang, Dairen, Changchun, Tiehling, Kirin, Harbin and Tsitsihar, and exercises no small influence in its own sphere. The Hongkong and Shanghai Banking Corporation has agencies in Dairen, Newchwang and Harbin, and the Chartered Bank of China, India and Australia only in Newchwang. These English banks confine their business chiefly to operations in exchange and, though important, their influence does not appear to be so great as in more southern provinces of China. Besides, there are two Russian local banks both having their offices only in Harbin and called the First Loan Bank and the Second Loan Bank. They were established in 1908 and 1910, and have capital of 3,090,000 and 1,080,000 roubles respectively.

Latest Banking Development.—The semi-annual report of the Bank of Chosen ending December 31, 1919, has the following:—

"To describe the recent banking conditions in Manchuria, there are in Manchuria at present 75 banking offices, inclusive of both head and branch offices, managed by Japanese (including 18 of our offices). At the end of November, 1919, the deposits on gold account with these banking offices stood at Y. 91,000,000 and advances, also in gold, at Y. 168,000,000. A comparison of these figures with those of a year ago will show that the deposits have increased by 50 per cent. and advances by 90 per cent. On the same date the balance in silver with them showed Y. 9,900,000 of deposits and Y. 78,600,000 of advances. On the other hand, clearings by the Mukden clearing house (where gold only is handled) ranged between Y. 7,000,000 and Y. 8,000,000 per month, while that by Dairen clearing house reached Y. 200,000,000 on gold account and over Y. 30,000,000 on that in silver. Thus the Dairen clearing house now occupies a place second only to those in Tokyo, Osaka, Kobe and Yokohama. The great demand for funds in Manchuria will be evident from this fact alone. The establishment of new local banks and the extension of existing ones taking place in Manchuria in recent years, is but a natural sequence of this demand, and we doubt not that the healthy development of these institutions will greatly contribute to the economic welfare of Manchuria."